

Project Manual For:

**Southern Maine Community College
Health Science Center Renovations**

South Portland, Maine

Construction Documents

LBA Project # 25-062-00 / BGS Project # 3809

8 May 2026

LAVALLEE | BRENSINGER ARCHITECTS

Boston | Manchester | Portland

www.LBPA.com

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SECTION 00 01 03
PROJECT DIRECTORY

OWNER

Southern Maine Community College

2 Fort Road, South Portland, Maine 04106

Telephone: (207) 741-5940 Email: mboden@mainecc.edu

Contact: Mitchell Boden, Project Manager

ARCHITECT

Lavallee Brensinger Architects (LBA)

305 Commercial Street, Portland, Maine 04101

Telephone: (207) 558-7202 Email: ben.patane@lbpa.com

Contact: Ben Patane, Project Manager

INTERIOR DESIGNER

Lavallee Brensinger Architects (LBA)

305 Commercial Street, Portland, Maine 04101

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Contact: Renée Bissonnette, Interior Designer

STRUCTURAL ENGINEERS

Foley Buhl Roberts & Associates

254 Commercial Street, Portland, Maine 04101

Telephone: (207) 200-2500 Email: dmartin@fbra.com

Contact: David Martin, P.E. Principal

FIRE PROTECTION, PLUMBING, MECHANICAL, ELECTRICAL ENGINEERS

Salas O'Brien

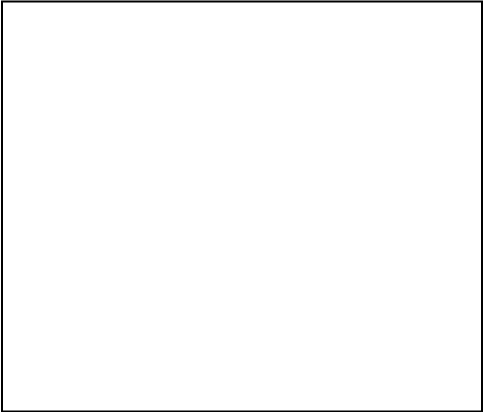
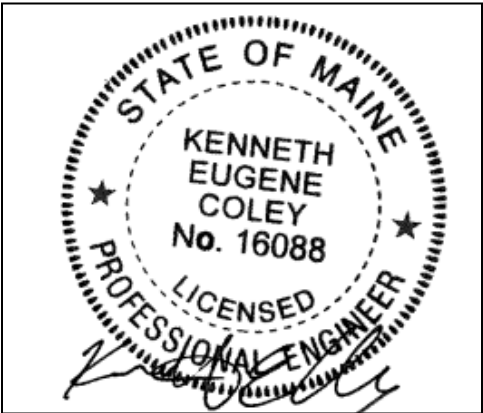
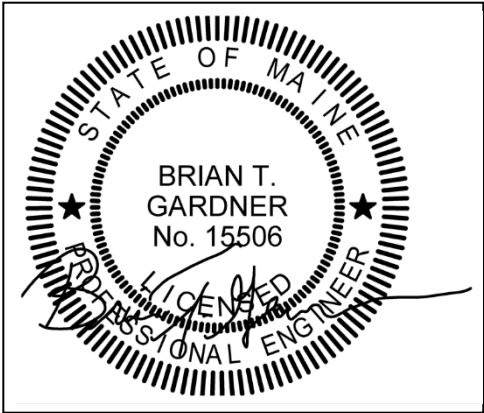
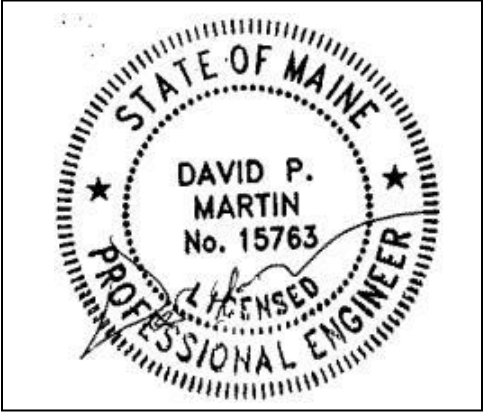
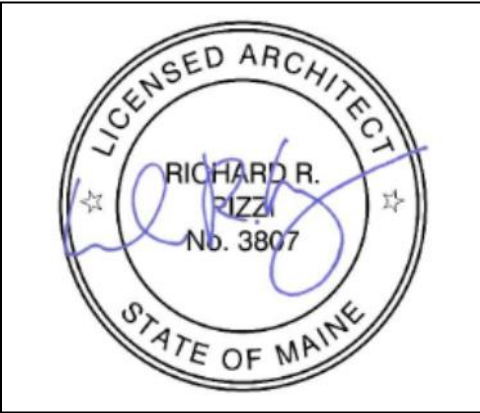
160 Veranda Street, Portland, ME 04103

Telephone: (207) 221-2260 Email: Kenneth.Coley@salasobrien.com

Contact: Ken Coley, Vice President / Mechanical Department Manager

END OF SECTION

SECTION 00 01 07
SEALS PAGE



00 11 13
Notice to Contractors

SMCC - Health Science Center Renovations

BGS #3809

Renovation of SMCC Health Science Center including a new simulation lab on the ground floor, classrooms and laboratory on the second floor, and miscellaneous renovations/alterations on all levels. Renovation includes a new fire protection system in accordance with NFPA 13 and other MEP renovations.

The contract shall designate the Substantial Completion Date on or before *2 April 2027*, and the Contract Final Completion Date on or before *2 May 2027*.

1. Submit bids on a completed Contractor Bid Form (section 00 41 13), provided in the Bid Documents, include bid security when required, and scan each item as an attachment to an email addressed to: BGS.Architect@Maine.gov, so as to be received no later than **1:30:00 p.m. on 18 June 2026**. The email subject line shall be marked "**Bid for SMCC - Health Science Center Renovations**".

Bid submissions will be opened and read aloud at **2:00 p.m.** on the date noted above at the Bureau of General Services office, accessible as a video conference call. Those who wish to participate in the call must submit a request for access to BGS.Architect@Maine.gov.

Any bid received after the noted time will not be considered a valid bid and will remain unopened. Any bid submitted by any other means will not be considered a valid bid. In certain circumstances, the Bureau of General Services may require the Bidder to surrender a valid paper copy of the bid form or the bid security document. The Owner reserves the right to accept or reject any or all bids as may best serve the interest of the Owner.

2. Questions and comments on the *bid opening process* shall be addressed to: Division of Planning, Design & Construction, Bureau of General Services, 77 State House Station, Augusta, Maine 04333-0077, BGS.Architect@Maine.gov.
3. Questions and comments regarding the *project* design specifications or drawings shall be directed in writing to the Consultant during the bid period prior to the question and comment deadline of 5:00 p.m. on *5 June 2026*.

Lavallee Brensinger Architects
Ben Patane
Ben.Patane@lbpa.com

4. ☒ Bid security is required on this project.
The Bidder shall include a satisfactory Bid Bond (section 00 43 13) or a certified or cashier's check for 5% of the bid amount with the completed bid form submitted to the Owner. The Bid Bond form is available on the BGS website.
or
☐ Bid security is not required on this project.

00 11 13
Notice to Contractors

5. ☒ Performance and Payment Bonds are required on this project.
If noted above as required, or if any combination of Base Bid and Alternate Bids amounts selected in the award of the contract exceeds \$125,000.00, the selected Contractor shall furnish a 100% contract Performance Bond (section 00 61 13.13) and a 100% contract Payment Bond (section 00 61 13.16) in the contract amount to cover the execution of the Work. Bond forms are available on the BGS website.
or
☐ Performance and Payment Bonds are not required on this project.
6. Filed Sub-bids *are not required* on this project.
7. ☐ Pre-qualified General Contractors are utilized on this project.
or
☒ Pre-qualified General Contractors are not utilized on this project.
8. ☒ An on-site pre-bid conference (☒ *mandatory* or ☐ *optional*) will be conducted for this project. The pre-bid conference is intended for General Contractors. Subcontractors and suppliers are welcome to attend. Contractors who arrive late or leave early for a mandatory meeting may be prohibited from participating in this meeting and bidding.
26 May 2026 at 2PM
79 Fort Road
South Portland, ME 04106
or
☐ An on-site pre-bid conference will not be conducted for this project.
9. Bid Documents - full sets only - will be available on or about *22 May 2026* and may be obtained *at market cost* from:
Xpress Copy
17 Westfield Street
Portland, ME 04102
(207) 775-2444, orders@xcopy.com
10. Bid Documents may be examined at:
AGC Maine
188 Whitten Road, Augusta, ME 04330
207-622-4741
Construction Summary
734 Chestnut Street, Manchester, NH 03104
603-627-8856

00 21 13
Instructions to Bidders

1. Bidder Requirements

- 1.1 A bidder is a Contractor which is evidently qualified, or has been specifically pre-qualified by the Bureau of General Services, to bid on the proposed project described in the Bid Documents.
- 1.2 Contractors and Subcontractors bidding on projects that utilize Filed Sub-bids shall follow the requirements outlined in these Bid Documents for such projects. See Section 00 22 13 for additional information.
- 1.3 Contractors and Subcontractors are not eligible to bid on the project when their access to project design documents prior to the bid period distribution of documents creates an unfair bidding advantage. Prohibited access includes consultation with the Owner or with design professionals engaged by the Owner regarding cost estimating, constructability review, or project scheduling. This prohibition to bid applies to open, competitive bidding or pre-qualified contractor bidding or Filed Sub-bidding. The Bureau may require additional information to determine if the activities of a Contractor constitute an unfair bidding advantage.
- 1.4 Each bidder is responsible for becoming thoroughly familiar with the Bid Documents prior to submitting a bid. The failure of a bidder to review evident site conditions, to attend available pre-bid conferences, or to receive, examine, or act on addenda to the Bid Documents shall not relieve that bidder from any obligation with respect to their bid or the execution of the work as a Contractor.
- 1.5 Prior to the award of the contract, General Contractor bidders or Filed Sub-bidders may be required to provide documented evidence to the Owner or the Bureau showing compliance with the provisions of this section, their business experience, financial capability, or performance on previous projects.
- 1.6 The selected General Contractor bidder will be required to provide proof of insurance before a contract can be executed.
- 1.7 Contracts developed from this bid shall not be assigned, sublet or transferred without the written consent of the Owner.
- 1.8 By submitting a bid the Contractor attests that it has not been declared ineligible to bid on State of Maine projects. The Director of the Bureau of General Services may disallow award of this contract to any Contractor if there is evidence that the Contractor or any of its Subcontractors, through their own fault, have been terminated, suspended for cause, debarred from bidding, agreed to refrain from bidding as part of a settlement, have defaulted on a contract, or had a contract completed by another party.
- 1.9 The Contractor attests that it is not presently indicted for or otherwise criminally or civilly charged by a Federal, State or local government entity with commission of any of the following offenses and has not within a three-year period preceding this bid been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction, or contract under a public transaction, violation of Federal or State anti-trust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property.

00 21 13
Instructions to Bidders

- 1.10 The Contractor shall not make any award or permit any award (subgrant or contract) at any tier to any party which is debarred or suspended or is otherwise excluded from or ineligible for participation in Federal assistance programs or State of Maine projects.
2. Authority of Owner
 - 2.1 The Owner reserves the right to accept or reject any or all bids as may best serve the interest of the Owner.
 - 2.2 Subject to the Owner's stated right to accept or reject any or all bids, the Contractor shall be selected on the basis of the lowest dollar value of an acceptable Base Bid, or any combination of Base Bid plus Alternate Bids, as well as other limited cost modifications the Owner determines may best serve the interests of the Owner. An acceptable bid is a duly submitted bid from a responsive and responsible bidder.
 - 2.3 The Owner reserves the right to require Bid Bonds or Performance and Payment Bonds for any project of any contract value.
3. Submitting Bids and Bid Requirements
 - 3.1 Each bid shall be submitted on the forms provided in the Bid Documents.
 - 3.2 Each bid shall be valid for a period of thirty calendar days following the Project bid closing date and time. The bid expiration date may be extended in unusual circumstances by mutual consent of the Bidder and the Owner. The bid amount shall not be modified due to the bid expiration date extension.
 - 3.3 Any provision contained in a bid which shows cost escalation, or any modification of schedule or other requirements shall not be accepted. Such a provision causes the bid to be invalid, or, at the discretion of the Owner and BGS, that element of the bid submission may be disregarded for the purpose of awarding the contract without that provision.
 - 3.4 Bidders shall include a Bid Bond or other approved bid security with the bid form submitted to the Owner when the bid form indicates such bid security is required. The bond value shall be 5% of the bid amount. The form of bond is shown in section 00 43 13.
 - 3.5 Bidders recognize that inclusion of contract bonds and the cost of those bonds is dependent on the awarded contract dollar value. Therefore, a Base Bid, or any combination of Base Bid plus Alternate Bids, as well as other limited cost modifications, resulting in a contract award shall include the cost of Performance and Payment Bonds in the submitted bid amount when the construction contract value is over \$125,000.00. Similarly, the cost of Performance and Payment Bonds is excluded in the submitted bid amount when the construction contract value is \$125,000.00 or less unless bonds are specifically required by the Bid Documents. When required for the project, the selected Contractor shall provide these bonds before a contract can be executed, pursuant to 14 M.R.S.A., Section 871, Public Works Contractors' Surety Bond Law of 1971, subsection 3. The form of bonds is shown in section 00 61 13.13 and 00 61 13.16.

00 21 13
Instructions to Bidders

- 3.6 Bidders may modify bids in writing, by the same means as the original bid submission, prior to the bid closing time. Such written amendments shall not disclose the amount of the initial bid. If so disclosed, the entire bid is considered invalid.
- 3.7 Bidders implicitly acknowledge all Addenda issued when they submit the bid form. By usual practice the Consultant shall not issue Addenda less than 72 hours prior to the bid closing time, to allow ample time for bidders to incorporate the information. However, some information, such as extending the bid due date and time, may be issued with shorter notice. Addenda shall be issued to all companies who are registered holders of Bid Documents.
- 3.8 A bid may be withdrawn without penalty if a written request by the bidder is presented to the Owner prior to the bid closing time. Such written withdrawal requests are subject to verification as required by the Bureau.
- A bid may be withdrawn without penalty after the bid closing time if, in the determination of the Bureau, evidence provided by the Contractor shows an apparent unintended error such as a miscalculation, or an erroneous number on estimating documents, was the cause of an inaccurate bid. The Bureau may allow withdrawal in consideration of the bid bond or, without utilizing a bid bond, if the Bureau considers documented evidence provided by the Contractor shows factual errors had been made on the bid form.
- 3.9 In the event State of Maine Offices unexpectedly close on the published date of a public bid opening in the location of that bid opening, prior to the time of the scheduled deadline, the new deadline for the public bid opening will be the following business day at the originally scheduled hour of the day, at the original location. Official closings are posted on the State of Maine government website.
- 3.10 The Owner may require, in a Notice of Intent to Award letter to the apparent low bidder, a Schedule of Values, Project Schedule, and List of Subcontractors and Suppliers as both a demonstration of capability of the Bidder and as a condition of award.
- 3.11 Projects which require a State of Maine wage determination will include that schedule as part of the Bid Documents. See section 00 73 46, if such rates are required.
- 3.12 Projects which require compliance with the Davis-Bacon Act are subject to the regulations contained the Code for Federal Regulations and the federal wage determination which is made a part of the Bid Documents. See section 00 73 46, if such rates are required.
- 3.13 The Owner is exempt from the payment of Maine State sales and use taxes as provided in 36 M.R.S. §1760 (1). The Contractor and Subcontractors shall not include taxes on exempt items in the construction contract.

00 41 13
Contractor Bid Form

SMCC - Health Science Center Renovations

BGS #3809

Bid Form submitted by: *email only to email address below*

Bid Administrator:

BGS.Architect@Maine.gov

Bureau of General Services
111 Sewall Street, Cross State Office Building, 4th floor
77 State House Station
Augusta, Maine 04333-0077

Bidder:

Signature: _____

Printed name and
title: _____

Company name: _____

Mailing address: _____

City, state, zip code: _____

Phone number: _____

Email address: _____

State of
incorporation,
if a corporation: _____

List of all partners,
if a partnership: _____

The Bidder agrees, if the Owner offers to award the contract, to provide any and all bonds and certificates of insurance, as well as Schedule of Values, Project Schedule, and List of Subcontractors and Suppliers if required by the Owner, and to sign the designated Construction Contract within twelve calendar days after the date of notification of such acceptance, except if the twelfth day falls on a State of Maine government holiday or other closure day, or a Saturday, or a Sunday, in which case the aforementioned documents must be received before 12:00 noon on the first available business day following the holiday, other closure day, Saturday, or Sunday.

As a guarantee thereof, the Bidder submits, together with this bid, a bid bond or other acceptable instrument as and if required by the Bid Documents.

00 41 13
Contractor Bid Form

1. The Bidder, having carefully examined the *SMCC - Health Science Center Renovations* Project Manual dated *8 May 2026*, prepared by *Lavallee Brensinger Architects*, as well as Specifications, Drawings, and any Addenda, the form of contract, and the premises and conditions relating to the work, proposes to furnish all labor, equipment and materials necessary for and reasonably incidental to the construction and completion of this project for the **Base Bid** amount of:

\$ _____ .00

2. Allowances *are not included* on this project.
No Allowances

1 Not Used \$ 0.00

2 Not Used \$ 0.00

3 Not Used \$ 0.00

4 Not Used \$ 0.00

3. Alternate Bids *are included* on this project.
Alternate Bids are as shown below

Any dollar amount line below that is left blank by the Bidder shall be read as a bid of **\$0.00**.

1 Alternate No.1 - Basement Slab Remediation \$ _____ .00

2 Alternate No. 2 - RTU-1 Replacement \$ _____ .00

3 Alternate No.3 - ADA Door Hardware \$ _____ .00

4 Not Used \$ _____ .00

4. Bid security *is required* on this project.

If noted above as required, or if the Base Bid amount exceeds \$125,000.00, the Bidder shall include with this bid form a satisfactory Bid Bond (section 00 43 13) or a certified or cashier's check for 5% of the bid amount with this completed bid form submitted to the Owner.

5. Filed Sub-bids *are not required* on this project.

If noted above as required, the Bidder shall include with this bid form a list of each Filed Sub-bidder selected by the Bidder on the form provided (section 00 41 13F).

00 43 13
Contractor Bid Bond

Bond No.: insert bond number

We, the undersigned, insert company name of Contractor, select type of entity of insert name of municipality in the State of insert name of state as principal, and insert name of surety as Surety, are hereby held and firmly bound unto select title of obligee in the penal sum of five percent of the bid amount, for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns, signed this insert date, i.e.: 8th day of select month, select year, which is the same date as that of the first specified bid due date, or subsequent bid due date revised by addendum.

The condition of the above obligation is such that whereas the principal has submitted to the Owner, or State of Maine, to a certain bid, attached hereto and hereby made a part hereof, to enter into a contract in writing, for the construction of insert name of project as designated in the contract documents

Now therefore:

If said bid shall be rejected, or, in the alternate,

If said bid shall be accepted and the principal shall execute and deliver a contract in the form of contract attached hereto, properly completed in accordance with said bid, and shall furnish a bond for the faithful performance of said contract, and for the payment of all persons performing labor or furnishing material in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said bid, then this obligation shall be void.

Otherwise, the same shall remain in force and effect- it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

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

00 43 13
Contractor Bid Bond

In witness whereof, the principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set above.

Signed and sealed this *insert date, i.e.: 8th* day of *select month, select year*, which is the same date as that of the first specified bid due date, or subsequent bid due date revised by addendum.

Contractor

(Signature)

insert name and title

insert company name

insert address
insert city state zip code

Surety

(Signature)

insert name and title

insert company name

insert address
insert city state zip code

If Contractor is a partnership, all partners shall execute the bond. A power of attorney document indicating that it still is in full force and effect shall be provided by the person executing this bond.

00 43 16
Subcontractor Bid Bond

Bond No.: insert bond number

We, the undersigned, insert company name of Subcontractor, select type of entity of insert name of municipality in the State of insert name of state as principal, and insert name of surety as Surety, are hereby held and firmly bound unto select title of obligee in the penal sum of five percent of the bid amount, for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns, signed this insert date, i.e.: 8th day of select month, select year, which is the same date as that of the first specified Subcontractor bid due date, or subsequent bid due date revised by addendum.

The condition of the above obligation is such that whereas the principal has submitted to the Owner, or State of Maine, to a certain Subcontractor bid, attached hereto and hereby made a part hereof, to enter into a subcontract in writing with any Contractor listed in said Subcontractor bid, provided the designated Contractor has entered into a written agreement with the Owner, for the construction of insert name of project as designated in the contract documents.

Now therefore:

If said Subcontractor bid shall be rejected, or, in the alternate,

If said Subcontractor bid shall be accepted and the principal shall execute and deliver a subcontract to the Contractor designated by the Owner in the form of subcontract attached hereto, properly completed in accordance with said Subcontractor bid, and shall furnish a bond for the faithful performance of said subcontract, and for the payment of all persons performing labor or furnishing material in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said Subcontractor bid, then this obligation shall be void.

Otherwise, the same shall remain in force and effect- it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received hereby stipulates and agrees that the obligation of said Surety and its bonds shall be in no way impaired or affected by any extension of the time within which the Obligee may accept such Subcontractor bid and said Surety does hereby waive notice of any such extension.

00 43 16
Subcontractor Bid Bond

In witness whereof, the principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set above.

Signed and sealed this *insert date, i.e.: 8th* day of *select month, select year*, which is the first specified Subcontractor bid due date, or subsequent bid due date revised by addendum.

Subcontractor

(Signature)

insert name and title

insert company name

insert address
insert city state zip code

Surety

(Signature)

insert name and title

insert company name

insert address
insert city state zip code

If Subcontractor is a partnership, all partners shall execute the bond. A power of attorney document indicating that it still is in full force and effect shall be provided by the person executing this bond.

State of Maine CONSTRUCTION CONTRACT

Large Construction Project

*This form is used when the Contract value is \$50,000 or greater.
The Project Manual, Specifications and Drawings, and any Addenda are considered part of this Contract.*

Agreement entered into by and between the contracting entity name hereinafter called the **Owner** and Contractor company name hereinafter called the **Contractor**.

BGS Project No.: number assigned by BGS

Other Project No.: _____

For the following Project: title of project as shown on bid documents at facility or campus name, municipality, Maine.

The Specifications and the Drawings have been prepared by Consultant firm name, acting as Professional-of-Record and named in the documents as the Consultant Architect or Engineer.

The *Owner* and *Contractor* agree as follows:

ARTICLE 1 COMPENSATION AND PAYMENTS

1.1 The Owner shall pay the Contractor to furnish all labor, equipment, materials and incidentals necessary for the construction of the Work described in the Specifications and shown on the Drawings the Contract Amount as shown below.

Base Bid	<u>\$0.00</u>
<u>Alternate Bid number and name or "no Alternates"</u>	<u>\$0.00</u>
<u>Alternate Bid number and name or "no Alternates"</u>	<u>\$0.00</u>
<u>Alternate Bid number and name or "no Alternates"</u>	<u>\$0.00</u>
<u>Alternate Bid number and name or "no Alternates"</u>	<u>\$0.00</u>
<u>Alternate Bid number and name or "no Alternates"</u>	<u>\$0.00</u>
Total Contract Amount	<u>\$0.00</u>

1.2 The Contractor's requisition shall contain sufficient detail and supporting information for the Owner to evaluate and support the payment requested.

1.2.1 Payments are due and payable twenty-five working days from the date of receipt of a Contractor requisition which is approved by the Owner.

1.2.2 Provisions for late payments are governed by 5 M.R.S. Chapter 144, *Payment of Invoices Received from Business Concerns*, and interest shall be calculated at 1% per month.

ARTICLE 2 COMMENCEMENT AND COMPLETION DATES

2.1 The Work of this Contract shall commence no sooner than the date this document is executed by the approval authority, or a subsequent date designated in the contract documents.

2.2 The Substantial Completion Date shall be _____.

2.3 The Work of this Contract shall be completed on or before the Contract Final Completion Date of _____.

2.4 The Contract Expiration Date shall be _____. (This date is the Owner's deadline for internal management of contract accounts. The Contract Expiration Date does not directly relate to any contract obligation of the Contractor.)

ARTICLE 3 INELIGIBLE BIDDER

3.1 By signing this contract the Contractor attests that it has not been declared ineligible to bid on State of Maine projects. The Bureau of General Services may disallow award of this contract to any Contractor if there is evidence that the Contractor or any of its Subcontractors, through their own fault, have been terminated, suspended for cause, debarred from bidding, agreed to refrain from bidding as part of a settlement, have defaulted on a contract, or had a contract completed by another party.

3.2 By signing this contract the Contractor attests that it is not presently indicted for or otherwise criminally or civilly charged by a Federal, State or local government entity with commission of any of the following offenses and has not within a three-year period preceding this bid been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction, or contract under a public transaction, violation of Federal or State anti-trust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property.

3.3 The Contractor shall not make any award or permit any award (subgrant or contract) at any tier to any party which is debarred or suspended or is otherwise excluded from or ineligible for participation in Federal assistance programs or State of Maine projects.

ARTICLE 4 CONTRACTOR'S RESPONSIBILITIES

4.1 On this project, the Contractor shall furnish the Owner the appropriate contract bonds in the amount of 100% of the Contract Sum. Contract bonds are mandated if the Contract Sum exceeds \$125,000, or if bonds are specifically required by the Contract Documents.

4.2 The Contractor shall comply with all laws, codes and regulations applicable to the Work.

4.3 The Contractor shall acquire all permits and third-party approvals applicable to the Work not specifically identified as provided by the Owner. Costs for Contractor-provided permits and third-party approvals shall be included in the Contract Sum identified in Section 1.1 above.

4.4 The Contractor shall remain an independent agent for the duration of this Contract, shall not become an employee of the State of Maine, and shall assure that no State employee will be compensated by, or otherwise benefit from, this Contract.

4.5 The Contractor shall be responsible for any design cost, construction cost, or other cost incurred on the Project to the extent caused by the negligent acts, errors or omissions of the Contractor or their Subcontractors in the performance of Work under this Contract.

ARTICLE 5 OWNER'S RESPONSIBILITIES

5.1 The Owner shall provide full information about the objectives, schedule, constraints and existing conditions of the project. The Owner has established a budget with reasonable contingencies that meets the project requirements.

5.2 By signing this contract, the Owner attests that all State of Maine procurement requirements for this contract have been met, including the solicitation of competitive bids.

ARTICLE 6 INSTRUMENTS OF SERVICE

6.1 The Contractor's use of the drawings, specifications and other documents known as the Consultant's Instruments of Service is limited to the execution of the Contractor's scope of work of this project unless the Contractor receives the written consent of the Owner and Consultant for use elsewhere.

ARTICLE 7 MISCELLANEOUS PROVISIONS

7.1 This Contract shall be governed by the laws of the State of Maine.

7.2 The Owner and Contractor, respectively, bind themselves, their partners, successors, assigns and legal representatives to this Contract. Neither party to this Contract shall assign the Contract as a whole without written consent of the other party, which consent the Owner may withhold without cause.

7.3 Notwithstanding any other provision of this Agreement, if the Owner does not receive sufficient funds to fund this Agreement or funds are de-appropriated, or if the Owner does not receive legal authority from the Maine State Legislature or Maine Courts to expend funds intended for this Agreement, then the Owner is not obligated to make payment under this Agreement; provided, however, the Owner shall be obligated to pay for services satisfactorily performed prior to any such non-appropriation in accordance with the termination provisions of this Agreement. The Owner shall timely notify the Contractor of any non-appropriation and the effective date of the non-appropriation.

ARTICLE 8 CONTRACT DOCUMENTS

8.1 The Project Manual, Specifications and Drawings, and any Addenda, together with this agreement, form the contract. Each element is as fully a part of the Contract as if hereto attached or herein repeated.

8.2 Specifications: *indicate date of issuance of project manual*

8.3 Drawings: *note here or attach each sheet number and title*

8.4 Addenda: *note each addenda number and date, or "none"*

BGS Project No.: _____

The Contract is effective as of the date executed by the approval authority.

OWNER**CONTRACTOR**

Signature Date
name and title

name of contracting entity
address

telephone
email address

Signature Date
name and title

name of contractor company
address

telephone
email address
Vendor Number

Indicate the names of the review and approval individuals appropriate to the approval authority.

select proper approval authority			
Reviewed by:		Approved by:	
_____ <i>Signature Date</i> <i>insert name</i>		_____ <i>Signature Date</i> <i>John Kenney, P.E.</i>	
<i>Project Manager/ Contract Administrator</i>		<i>Director, Planning Design and Construction Division (PDCD)</i>	

00 52 16
Subcontract Agreement

State of Maine
CONSTRUCTION SUBCONTRACT

Agreement entered into by and between the Contractor company name hereinafter called the *Contractor*, and Subcontractor company name hereinafter called the *Subcontractor*.

The *Contractor* and the *Subcontractor* agree as follows:

ARTICLE 1 COMPENSATION AND PAYMENTS

1.1 The Contractor shall pay the Subcontractor to perform the subcontract Work described in the Specifications and shown on the Drawings and defined by attachments to this subcontract the Contract Sum of \$0.00.

ARTICLE 2 TIME OF COMPLETION

2.1 The Work of this Contract shall be completed according to the established construction schedule, on or before the Contract Final Completion Date of 31 December 2024.

ARTICLE 3 INELIGIBLE BIDDER

3.1 By signing this subcontract the Subcontractor attests that it has not been declared ineligible to bid on State of Maine projects. The Bureau of General Services may disallow award of this contract to any Subcontractor if there is evidence that the Subcontractor, through their own fault, have been terminated, suspended for cause, debarred from bidding, agreed to refrain from bidding as part of a settlement, have defaulted on a contract, or had a contract completed by another party.

3.2 By signing this contract the Subcontractor attests that it is not presently indicted for or otherwise criminally or civilly charged by a Federal, State or local government entity with commission of any of the following offenses and has not within a three-year period preceding this bid been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction, or contract under a public transaction, violation of Federal or State anti-trust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property.

3.3 The Subcontractor shall not make any award or permit any award (subgrant or contract) at any tier to any party which is debarred or suspended or is otherwise excluded from or ineligible for participation in Federal assistance programs or State of Maine projects.

ARTICLE 4 SUBCONTRACTOR'S RESPONSIBILITIES

4.1 The *Subcontractor* shall furnish all of the materials and perform all the Work described in the Specifications and shown on the Drawings for the project entitled: title of project shown on documents prepared by Architect - Engineer firm name, for the specification sections here described: list all sections- for this subcontract only- by number and name.

4.2 *Not used.*

00 52 16
Subcontract Agreement

4.3 The Subcontractor shall comply with all laws, codes and regulations applicable to the Work.

4.4 *Not used.*

4.5 The Subcontractor shall remain an independent agent for the duration of this subcontract, shall not become an employee of the State of Maine, and shall assure that no State employee will be compensated by, or otherwise benefit from, this subcontract.

ARTICLE 5 CONTRACTOR'S RESPONSIBILITIES

5.1 The Contractor shall share all relevant available information about the objectives, schedule, constraints and existing conditions of the project.

ARTICLE 6 INSTRUMENTS OF SERVICE

6.1 The Subcontractor's use of the Drawings, Specifications and other documents known as the Consultant's Instruments of Service is limited to the execution of the Subcontractor's scope of work of this project unless the Subcontractor receives the written consent of the Owner and Consultant for use elsewhere.

ARTICLE 7 MISCELLANEOUS PROVISIONS

7.1 This Contract shall be governed by the laws of the State of Maine.

7.2 The Contractor and Subcontractor, respectively, bind themselves, their partners, successors, assigns and legal representatives to this Contract. Neither party to this Contract shall assign the Contract as a whole without written consent of the other party, which consent the Contractor may withhold without cause.

7.3 Subcontract bonds are required for projects utilizing Filed Sub-bids. The Subcontractor shall furnish the Contractor the appropriate subcontract bonds in the amount of 100% of the contract amount.

7.4 The Contractor shall make payments on account of the subcontract as provided therein as follows: each month 95% of the value, based on contract prices of labor and materials incorporated in the Work and of materials suitably stored at the site thereof up to the first day of that month, as certified by the Architect or Engineer.

7.5 Final payment shall be due 60 days after completion and acceptance of the Work, provided the Subcontractor has submitted evidence satisfactory to the Contractor and the Owner that all payrolls, material bills and other indebtedness connected with the Work has been paid.

7.6 Other provisions. *There are no other provisions.*

ARTICLE 8 CONTRACT DOCUMENTS

8.1 The Project Manual, Specifications and Drawings, and any Addenda, together with this agreement, form the contract. Each element is as fully a part of the Contract as if hereto attached or herein repeated.

8.2 Specifications: *indicate date of issuance of project manual*

00 52 16
Subcontract Agreement

8.3 Drawings: *note each sheet number and title*

8.4 Addenda: *note each addenda number and date, or "none"*

SAMPLE

00 52 16
Subcontract Agreement

The Agreement is effective as of the date last executed by the parties.

CONTRACTOR**SUBCONTRACTOR**

<u>(Signature)</u>	<u>(Date)</u>
<u>name and title</u>	
<u>name of contracting entity</u>	

<u>(Signature)</u>	<u>(Date)</u>
<u>name and title</u>	
<u>name of contractor company</u>	

00 61 13.13
Contractor Performance Bond

Bond No.: insert bond number

We, the undersigned, insert company name of Contractor, select type of entity of insert name of municipality in the State of insert name of state as principal, and insert name of surety as Surety, are hereby held and firmly bound unto select title of obligee in the penal sum of the Contract Price \$ insert the Contract Price in numbers for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

The condition of the above obligation is such that if the principal shall promptly and faithfully perform the contract entered into this insert date, i.e.: 8th day of select month, select year, which is the same date as that of the notice of intent to award letter, or in the absence of such a letter, not later than the date the Owner signs the construction contract, for the construction of insert name of project as designated in the contract documents, then this obligation shall be null and void.

Otherwise, the same shall remain in force and effect- it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received hereby stipulates and agrees that the obligation of said Surety and its bonds shall be in no way impaired or affected by any extension of the time which the Obligee may accept during the performance of the contract and said Surety does hereby waive notice of any such extension.

00 61 13.13
Contractor Performance Bond

In witness whereof, the principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set above.

Signed and sealed this *insert date, i.e.: 8th* day of *select month, select year*, which is the same date as that of the notice of intent to award letter, or in the absence of such a letter, not later than the date the Owner signs the construction contract.

Contractor

(Signature)

insert name and title

insert company name

insert address

insert city state zip code

Surety

(Signature)

insert name and title

insert company name

insert address

insert city state zip code

If Contractor is a partnership, all partners shall execute the bond. A power of attorney document indicating that it still is in full force and effect shall be provided by the person executing this bond.

00 61 13.16
Contractor Payment Bond

Bond No.: insert bond number

We, the undersigned, insert company name of Contractor, select type of entity of insert name of municipality in the State of insert name of state as principal, and insert name of surety as Surety, are hereby held and firmly bound unto select title of obligee in the penal sum of the Contract Price \$ insert the Contract Price in numbers for the use and benefit of claimants, defined as an entity having a contract with the principal or with a subcontractor of the principal for labor, materials, or both labor and materials, used or reasonably required for use in the performance of the contract, for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

The condition of the above obligation is such that if the principal shall promptly satisfy all claims and demands incurred for all labor and materials, used or required by the principal in connection with the work described in the contract entered into this insert date, i.e.: 8th day of select month, select year, which is the same date as that of the notice of intent to award letter, or in the absence of such a letter, not later than the date the Owner signs the construction contract, for the construction of insert name of project as designated in the contract documents, and shall fully reimburse the obligee for all outlay and expense with said obligee may incur in making good any default of said principal, then this obligation shall be null and void.

Otherwise, the same shall remain in force and effect- it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received hereby stipulates and agrees that the obligation of said Surety and its bonds shall be in no way impaired or affected by any extension of the time which the Obligee may accept during the performance of the contract and said Surety does hereby waive notice of any such extension.

00 61 13.16
Contractor Payment Bond

In witness whereof, the principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set above.

Signed and sealed this *insert date, i.e.: 8th* day of *select month, select year*, which is the same date as that of the notice of intent to award letter, or in the absence of such a letter, not later than the date the Owner signs the construction contract.

Contractor

(Signature)

insert name and title

insert company name

insert address

insert city state zip code

Surety

(Signature)

insert name and title

insert company name

insert address

insert city state zip code

If Contractor is a partnership, all partners shall execute the bond. A power of attorney document indicating that it still is in full force and effect shall be provided by the person executing this bond.

00 71 00
Definitions

1. Definitions

- 1.1 *Addendum*: A document issued by the Consultant that amends the Bid Documents. Addenda shall not be issued less than seventy-two hours prior to the specified bid opening time.
- 1.2 *Allowance*: A specified dollar amount for a particular scope of work or service included in the Work that is identified in the Bid Documents and included in each Bidder's Bid. The Contractor shall document expenditures for an Allowance during the Project. Any unused balance shall be credited to the Owner. The Contractor is responsible for notifying the Owner of anticipated expenses greater than the specified amount and the Owner is responsible for those additional expenses.
- 1.3 *Alternate Bid*: The Contractor's written offer of a specified dollar amount, submitted on the Bid Form, for the performance of a particular scope of work described in the Bid Documents. The Owner determines the low bidder based on the sum of the base Bid and any combination of Alternate Bids that the Owner selects.
- 1.4 *Architect*: A Consultant acting as, or supporting, the Professional-of-Record who is responsible for the design of the Project. Equivalent to "Consultant" in State of Maine contract forms.
- 1.5 *Architectural Supplemental Instruction (ASI)*: A written instruction from the Architect for the purpose of clarification of the Contract Documents. An ASI does not alter the Contract Price or Contract Time. ASIs may be responses to RFIs and shall be issued by the Architect in a timely manner to avoid any negative impact on the Schedule of the Work.
- 1.6 *Bid*: The Contractor's written offer of a specified dollar amount or amounts, submitted on a form included in the Bid Documents, for the performance of the Work. A Bid may include bonds or other requirements. A base Bid is separate and distinct from Alternate Bids, being the only cost component necessary for the award of the contract, and representing the minimum amount of Work that is essential for the functioning of the Project.
- 1.7 *Bid Bond*: The security designated in the Bid Documents, furnished by Bidders as a guaranty of good faith to enter into a contract with the Owner, should a contract be awarded to that Bidder.
- 1.8 *Bidder*: Any business entity, individual or corporation that submits a bid for the performance of the work described in the Bid Documents, acting directly or through a duly authorized representative. See also *Responsive and Responsible Bidder*.
- 1.9 *Bid Documents*: The drawings, procurement and contracting requirements, general requirements, and the written specifications -including all addenda, that a bidder is required to reference in the submission of a bid.
- 1.10 *Bureau*: The State of Maine Bureau of General Services, or BGS, in the Department of Administrative and Financial Services.
- 1.11 *Calendar days*: Consecutive days, as occurring on a calendar, taking into account each day of the week, month, year, and any religious, national or local holidays. Calendar days are used for changes in Contract Time.

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Definitions

- 1.12 *Certificate of Substantial Completion*: A document developed by the Consultant that describes the final status of the Work and establishes the date that the Owner may use the facility for its intended purpose. The Certificate of Substantial Completion may also include a provisional list of items - a "punch list" - remaining to be completed by the Contractor. The Certificate of Substantial Completion identifies the date from which the project warranty period commences.
- 1.13 *Certificate of Occupancy*: A document developed by a local jurisdiction such as the Code Enforcement Officer that grants permission to the Owner to occupy a building.
- 1.14 *Change Order (CO)*: A document that modifies the contract and establishes the basis of a specific adjustment to the Contract Price or the Contract Time, or both. Change Orders may address correction of omissions, errors, and document discrepancies, or additional requirements. Change Orders should include all labor, materials and incidentals required to complete the work described. A Change Order is not valid until signed by the Contractor, Owner and Consultant and approved by the Bureau.
- 1.15 *Change Order Proposal (COP) (see also Proposal)*: Contract change proposed by the Contractor regarding the contract amount, requirements, or time. The Contractor implements the work of a COP after it is accepted by all parties. Accepted COPs are incorporated into the contract by Change Order.
- 1.16 *Clerk of the Works*: The authorized representative of the Consultant on the job site. Clerk of the Works is sometimes called the Architect's representative.
- 1.17 *Construction Change Directive (CCD)*: A written order prepared by the Consultant and signed by the Owner and Consultant, directing a change in the Work prior to final agreement with the Contractor on adjustment, if any, in the Contract Price or Contract Time, or both.
- 1.18 *Contract*: A written agreement between the Owner and the successful bidder which obligates the Contractor to perform the work specified in the Contract Documents and obligates the Owner to compensate the Contractor at the mutually accepted sum, rates or prices.
- 1.19 *Contract Bonds (also known as Payment and Performance Bonds)*: The approved forms of security, furnished by the Contractor and their surety, which guarantee the faithful performance of all the terms of the contract and the payment of all bills for labor, materials and equipment by the Contractor.
- 1.20 *Contract Documents*: The drawings and written specifications (including all addenda), Standard General Conditions, and the contract (including all Change Orders subsequently incorporated in the documents).
- 1.21 *Contract Expiration Date*: Date determined by the Owner as a deadline for internal management of contract accounts. This allows time after the Contract Final Completion Date for processing the final Requisition for Payment. The Contract Expiration Date does not directly relate to any contract obligation of the Contractor.
- 1.22 *Contract Final Completion Date*: Point of time when the Work is fully completed in compliance with the Contract Documents, as certified by the Consultant. Final payment to the Contractor is due upon Final Completion of the Project.
- 1.23 *Contract Price*: The dollar amount of the construction contract, also called *Contract Sum*.

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Definitions

- 1.24 *Contract Time*: The designated duration of time to execute the Work of the contract, with a specific date for completion.
- 1.25 *Contractor*: Also called the "General Contractor" or "GC" the individual or entity undertaking the execution of the general contract work under the terms of the contract with the Owner, acting directly or through a duly authorized representative. The Contractor is responsible for the means, methods and materials utilized in the execution and completion of the Work.
- 1.26 *Consultant*: The Architect or Engineer acting as Professional-of-Record for the Project. The Consultant is responsible for the design of the Project.
- 1.27 *Drawings*: The graphic and pictorial portion of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.
- 1.28 *Engineer*: A Consultant acting as, or supporting, the Professional-of-Record who is responsible for the design of the Project. Equivalent to "Consultant" in State of Maine contract forms.
- 1.29 *Filed Sub-bid*: The designated major Subcontractor's (or, in some cases, Contractor's) written offer of a specified dollar amount or amounts, submitted on a form included in the Bid Documents, for the performance of a particular portion of the Work. A Filed Sub-bid may include bonds or other requirements.
- 1.30 *General Requirements*: The on-site overhead expense items the Contractor provides for the Project, typically including, but not limited to, building permits, construction supervision, Contract Bonds, insurance, field office, temporary utilities, rubbish removal, and site fencing. Overhead expenses of the Contractor's general operation are not included. Sometimes referred to as the Contractor's General Conditions.
- 1.31 *Owner*: The State agency which is represented by duly authorized individuals. The Owner is responsible for defining the scope of the Project and compensation to the Consultant and Contractor.
- 1.32 *Owner's Representative*: The individual or entity contracted by the Owner to be an advisor and information conduit regarding the Project.
- 1.33 *Overhead*: General and administrative expenses of the Contractor's principal and branch offices, including payroll costs and other compensation of Contractor employees, deductibles paid on any insurance policy, charges against the Contractor for delinquent payments, and costs related to the correction of defective work, and the Contractor's capital expenses, including interest on capital used for the work.
- 1.34 *Performance and Payment Bonds (also known as Contract Bonds)*: The approved forms of security, furnished by the Contractor and their surety, which guarantee the faithful performance of all the terms of the contract and the payment of all bills for labor, materials and equipment by the Contractor.
- 1.35 *Post-Bid Addendum*: Document issued by the Consultant that defines a potential Change Order prior to signing of the construction contract. The Post-Bid Addendum allows the Owner to negotiate

00 71 00
Definitions

contract changes with the Bidder submitting the lowest valid bid, only if the negotiated changes to the Bid Documents result in no change or no increase in the bid price.

A Post-Bid Addendum may also be issued after a competitive construction Bid opening to those Bidders who submitted a Bid initially, for the purpose of rebidding the Project work without re-advertising.

- 1.36 *Project*: The construction project proposed by the Owner to be constructed according to the Contract Documents. The Project, a public improvement, may be tied logistically to other public improvements and other activities conducted by the Owner or other contractors.
- 1.37 *Proposal (see also Change Order Proposal)*: The Contractor's written offer submitted to the Owner for consideration containing a specified dollar amount or rate, for a specific scope of work, and including a schedule impact, if any. A proposal shall include all costs for overhead and profit. The Contractor implements the work of a Proposal after it is accepted by all parties. Accepted Proposals are incorporated into the contract by Change Order.
- 1.38 *Proposal Request (PR)*: An Owner's written request to the Contractor for a Change Order Proposal.
- 1.39 *Punch List*: A document that identifies the items of work remaining to be done by the Contractor at the Close Out of a Project. The Punch List is created as a result of a final inspection of the work only after the Contractor attests that all of the Work is in its complete and permanent status.
- 1.40 *Request For Information (RFI)*: A Contractor's written request to the Consultant for clarification, definition or description of the Work. RFIs shall be presented by the Contractor in a timely manner to avoid any negative impact on the Schedule of the Work.
- 1.41 *Request For Proposal (RFP)*: An Owner's written request to the Contractor for a Change Order Proposal.
- 1.42 *Requisition for Payment*: The document in which the Contractor certifies that the Work described is, to the best of the Contractor's knowledge, information and belief, complete and that all previous payments have been paid by the Contractor to Subcontractors and suppliers, and that the current requested payment is now due. See *Schedule of Values*.
- 1.43 *Responsive and Responsible Bidder*: A bidder who complies, when submitting a bid on a given project, with the following *responsive* standards, as required by the Bid Documents:
 - submits specific qualifications to bid the project, if required;
 - attends mandatory pre-bid conferences, if required;
 - submits a bid prior to the close of the bid period;
 - submits a complete bid form;
 - submits a bid without indications of intent contrary to the stated requirements;
 - submits other materials and information, such as bid security, as required;
 and, meets the following minimums regarding these *responsible* standards:
 - sustains a satisfactory record of project performance;
 - maintains a permanent place of business in a known physical location;
 - possesses the financial means for short- and long-term operations;
 - possesses the appropriate technical experience and capabilities;
 - employs adequate personnel and subcontractor resources;

00 71 00
Definitions

maintains the equipment needed to perform the work;
complies with the proposed implementation schedule;
complies with the insurance and bonding requirements;
provides post-construction warranty coverage;
and other criteria which can be considered relevant to the contract.

- 1.44 *Retainage*: The amount, calculated at five percent (5%) of the contract value or a scheduled value, that the Owner shall withhold from the Contractor until the work or portion of work is declared substantially complete or otherwise accepted by the Owner. The Owner may, if requested, reduce the amount withheld if the Owner deems it desirable and prudent to do so. (See Title 5 M.R.S.A., Section 1746.)
- 1.45 *Sample*: A physical example provided by the Contractor which illustrates materials, equipment or workmanship and establishes standards by which the Work will be judged.
- 1.46 *Schedule of the Work*: The document prepared by the Contractor and approved by the Owner that specifies the dates on which the Contractor plans to begin and complete various parts of the Work, including dates on which information and approvals are required from the Owner.
- 1.47 *Schedule of Values*: The document prepared by the Contractor and approved by the Owner before the commencement of the Work that specifies the dollar values of discrete portions of the Work equal in sum to the contract amount. The Schedule of Values is used to document progress payments of the Work in regular (usually monthly) requisitions for payment. See *Requisition for Payment*.
- 1.48 *Shop Drawings*: The drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.
- 1.49 *Specifications*: The portion of the Contract Documents consisting of the written requirements of the Work for materials, equipment, systems, standards, workmanship, and performance of related services.
- 1.50 *Subcontractor*: An individual or entity undertaking the execution of any part of the Work by virtue of a written agreement with the Contractor or any other Subcontractor. Also, an individual or entity retained by the Contractor or any other Subcontractor as an independent contractor to provide the labor, materials, equipment or services necessary to complete a specific portion of the Work.
- 1.51 *Substantial Completion Date*: Point of time when the Work or a designated portion of the Work is sufficiently complete in compliance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended purpose without unscheduled disruption. Substantial Completion is documented by the date of the Certificate of Substantial Completion signed by the Owner and the Contractor.
- 1.52 *Superintendent*: The representative of the Contractor on the job site, authorized by the Contractor to receive and fulfill instructions from the Consultant.
- 1.53 *Surety*: The individual or entity that is legally bound with the Contractor and Subcontractor to insure the faithful performance of the contract and for the payment of the bills for labor, materials and equipment by the Contractor and Subcontractors.

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Definitions

- 1.54 *Work*: The construction and services, whether completed or partially completed, including all labor, materials, equipment and services provided or to be provided by the Contractor and Subcontractors to fulfill the requirements of the Project as described in the Contract Documents.

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General Conditions

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1. Preconstruction Conference

- 1.1 The Contractor shall, upon acceptance of a contract and prior to commencing work, schedule a preconstruction conference with the Owner and Consultant. The purpose of this conference is as follows.
 - 1.1.1 Introduce all parties who have a significant role in the Project, including:
 - Owner (State agency or other contracting entity)
 - Owner's Representative
 - Consultant (Architect or Engineer)
 - Subconsultants
 - Clerk-of-the-works
 - Contractor (GC)
 - Superintendent
 - Subcontractors
 - Other State agencies
 - Construction testing company
 - Commissioning agent
 - Special Inspections agent
 - Bureau of General Services (BGS);
 - 1.1.2 Review the responsibilities of each party;
 - 1.1.3 Review any previously-identified special provisions of the Project;
 - 1.1.4 Review the Schedule of the Work calendar submitted by the Contractor to be approved by the Owner and Consultant;
 - 1.1.5 Review the Schedule of Values form submitted by the Contractor to be approved by the Owner and Consultant;
 - 1.1.6 Establish routines for Shop Drawing approval, contract changes, requisitions, et cetera;
 - 1.1.7 discuss jobsite issues;
 - 1.1.8 Discuss Project close-out procedures;
 - 1.1.9 Provide an opportunity for clarification of Contract Documents before work begins; and
 - 1.1.10 Schedule regular meetings at appropriate intervals for the review of the progress of the Work.

2. Intent and Correlation of Contract Documents

- 2.1 The intent of the Contract Documents is to describe the complete Project. The Contract Documents consist of various components; each component complements the others. What is shown as a requirement by any one component shall be inferred as a requirement on all corresponding components.
- 2.2 The Contractor shall furnish all labor, equipment and materials, tools, transportation, insurance, services, supplies, operations and methods necessary for, and reasonably incidental to, the construction and completion of the Project. Any work that deviates from the Contract Documents which appears to be required by the exigencies of construction or by inconsistencies in the Contract Documents, will be determined by the Consultant and authorized in writing by the Consultant, Owner and the Bureau prior to execution. The Contractor shall be responsible for requesting clarifying information where the intent of the Contract Documents is uncertain.
- 2.3 The Contractor shall not utilize any apparent error or omission in the Contract Documents to the disadvantage of the Owner. The Contractor shall promptly notify the Consultant in writing of

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such errors or omissions. The Consultant shall make any corrections or clarifications necessary in such a situation to document the true intent of the Contract Documents.

3. Additional Drawings and Specifications

- 3.1 Upon the written request of the Contractor, the Owner shall provide, at no expense to the Contractor, up to five sets of printed Drawings and Specifications for the execution of the Work.
- 3.2 The Consultant shall promptly furnish to the Contractor revised Drawings and Specifications, for the area of the documents where those revisions apply, when corrections or clarifications are made by the Consultant. All such information shall be consistent with, and reasonably inferred from, the Contract Documents. The Contractor shall do no work without the proper Drawings and Specifications.

4. Ownership of Contract Documents

- 4.1 The designs represented on the Contract Documents are the property of the Consultant. The Drawings and Specifications shall not be used on other work without consent of the Consultant.

5. Permits, Laws, and Regulations

- 5.1 The Owner is responsible for obtaining any zoning approvals or other similar local project approvals necessary to complete the Work, unless otherwise specified in the Contract Documents.
- 5.2 The Owner is responsible for obtaining Maine Department of Environmental Protection, Maine Department of Transportation, or other similar state government project approvals necessary to complete the Work, unless otherwise indicated in the Contract Documents.
- 5.3 The Owner is responsible for obtaining any federal agency project approvals necessary to complete the Work, unless otherwise indicated in the Contract Documents.
- 5.4 The Owner is responsible for obtaining all easements for permanent structures or permanent changes in existing facilities.
- 5.5 The Contractor is responsible for obtaining and paying for all permits and licenses necessary for the implementation of the Work. The Contractor shall notify the Owner of any delays, variance or restrictions that may result from the issuing of permits and licenses.
- 5.6 The Contractor shall comply with all ordinances, laws, rules and regulations and make all required notices bearing on the implementation of the Work. In the event the Contractor observes disagreement between the Drawings and Specifications and any ordinances, laws, rules and regulations, the Contractor shall promptly notify the Consultant in writing. Any necessary changes shall be made as provided in the contract for changes in the work. The Contractor shall not perform any work knowing it to be contrary to such ordinances, laws, rules and regulations.
- 5.7 The Contractor shall comply with local, state and federal regulations regarding construction safety and all other aspects of the Work.

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- 5.8 The Contractor shall comply with the Maine Code of Fair Practices and Affirmative Action, 5 M.R.S. §784 (2).

6. Taxes

- 6.1 The Owner is exempt from the payment of Maine State sales and use taxes as provided in 36 M.R.S. §1760 (1). The Contractor and Subcontractors shall not include taxes on exempt items in the construction contract.
- 6.2 Section 1760 further provides in subsection 61 that sales to a construction contractor or its subcontractor of tangible personal property that is to be physically incorporated in, and become a permanent part of, real property for sale to or owned by the Owner, are exempt from Maine State sales and use taxes. Tangible personal property is defined in 36 M.R.S. §1752 (17).
- 6.3 The Contractor may contact Maine Revenue Services, 24 State House Station, Augusta, Maine 04333 for guidance on tax exempt regulations authorized by 36 M.R.S. §1760 and detailed in Rule 302 (18-125 CMR 302).

7. Labor and Wages

- 7.1 The Contractor shall conform to the labor laws of the State of Maine, and all other laws, ordinances, and legal requirements affecting the work in Maine.
- 7.2 The Consultant shall include a wage determination document prepared by the Maine Department of Labor in the Contract Documents for state-funded contracts in excess of \$50,000. The document shows the minimum wages required to be paid to each category of labor employed on the project.
- 7.3 On projects requiring a Maine wage determination, the Contractor shall submit monthly payroll records to the Owner ("the contracting agency") showing the name and occupation of all workers and all independent contractors employed on the project. The monthly submission must also include the Contractor's company name, the title of the project, hours worked, hourly rate or other method of remuneration, and the actual wages or other compensation paid to each person.
- 7.4 The Contractor shall not reveal, in the payroll records submitted to the Owner, personal information regarding workers and independent contractors, other than the information described above. Such information shall not include Social Security number, employee identification number, or employee address or phone number, for example.
- 7.5 The Contractor shall conform to Maine statute (39-A M.R.S. §105-A (6)) by providing to the Workers' Compensation Board a list of all subcontractors and independent contractors on the job site and a record of the entity to whom that subcontractor or independent contractor is directly contracted and by whom that subcontractor or independent contractor is insured for workers' compensation purposes.
- 7.6 The Contractor shall enforce strict discipline and good order among their employees at all times, and shall not employ any person unfit or unskilled to do the work assigned to them.

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- 7.7 The Contractor shall promptly pay all employees when their compensation is due, shall promptly pay all others who have billed and are due for materials, supplies and services used in the Work, and shall promptly pay all others who have billed and are due for insurance, workers compensation coverage, federal and state unemployment compensation, and Social Security charges pertaining to this Project. Before final payments are made, the Contractor shall furnish to the Owner affidavits that all such payments described above have been made.
- 7.8 The Contractor may contact the Maine Department of Labor, 54 State House Station, Augusta, Maine 04333 for guidance on labor issues.
- 7.9 The Contractor may contact the Maine Workers' Compensation Board, 27 State House Station, Augusta, Maine 04333 for guidance on workers' compensation issues.

8. Indemnification

- 8.1 The Contractor shall indemnify and hold harmless the Owner and its officers and employees from and against any and all damages, liabilities, and costs, including reasonable attorney's fees, and defense costs, for any and all injuries to persons or property, including claims for violation of intellectual property rights, to the extent caused by the negligent acts or omissions of the Contractor, its employees, agents, officers or subcontractors in the performance of work under this Agreement. The Contractor shall not be liable for claims to the extent caused by the negligent acts or omissions of the Owner or for actions taken in reasonable reliance on written instructions of the Owner.
- 8.2 The Contractor shall notify the Owner promptly of all claims arising out of the performance of work under this Agreement by the Contractor, its employees or agents, officers or subcontractors.
- 8.3 This indemnity provision shall survive the termination of the Agreement, completion of the project or the expiration of the term of the Agreement.

9. Insurance Requirements

- 9.1 The Contractor shall provide, with each original of the signed Contract, an insurance certificate or certificates acceptable to the Owner and BGS. The Contractor shall submit insurance certificates to the Owner and BGS at the commencement of this Contract and at policy renewal or revision dates. The certificates shall identify the project name and BGS project number, and shall name the Owner as certificate holder and as additional insured for general liability and automobile liability coverages. The submitted forms shall contain a provision that coverage afforded under the insurance policies will not be canceled or materially changed unless at least ten days prior written notice by registered letter has been given to the Owner and BGS.
- 9.2 The Owner does not warrant or represent that the insurance required herein constitutes an insurance portfolio which adequately addresses all risks faced by the Contractor or its Subcontractors. The Contractor is responsible for the existence, extent and adequacy of insurance prior to commencement of work. The Contractor shall not allow any Subcontractor to commence work until all similar insurance required of the Subcontractor has been confirmed by the Contractor.

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- 9.3 The Contractor shall procure and maintain primary insurance for the duration of the Project and, if written on a Claims-Made basis, shall also procure and maintain Extended Reporting Period (ERP) insurance for the period of time that any claims could be brought. The Contractor shall ensure that all Subcontractors they engage or employ will procure and maintain similar insurance in form and amount acceptable to the Owner and BGS. At a minimum, the insurance shall be of the types and limits set forth herein protecting the Contractor from claims which may result from the Contractor's execution of the Work, whether such execution be by the Contractor or by those employed by the Contractor or by those for whose acts they may be liable. All required insurance coverages shall be placed with carriers authorized to conduct business in the State of Maine by the Maine Bureau of Insurance.
- 9.3.1 The Contractor shall have Workers' Compensation insurance for all employees on the Project site in accordance with the requirements of the Workers' Compensation law of the State of Maine. Minimum acceptable limits for Employer's Liability are:
- | | |
|--------------------------------|-------------------------|
| Bodily Injury by Accident..... | \$500,000 |
| Bodily Injury by Disease..... | \$500,000 Each Employee |
| Bodily Injury by Disease..... | \$500,000 Policy Limit |
- 9.3.2 The Contractor shall have Commercial General Liability insurance providing coverage for bodily injury and property damage liability for all hazards of the Project including premise and operations, products and completed operations, contractual, and personal injury liabilities. The policy shall include collapse and underground coverage as well as explosion coverage if explosion hazards exist. Aggregate limits shall apply on a location or project basis. Minimum acceptable limits are:
- | | |
|---|-------------|
| General aggregate limit..... | \$2,000,000 |
| Products and completed operations aggregate | \$1,000,000 |
| Each occurrence limit..... | \$1,000,000 |
| Personal injury aggregate | \$1,000,000 |
- 9.3.3 The Contractor shall have Automobile Liability insurance against claims for bodily injury, death or property damage resulting from the maintenance, ownership or use of all owned, non-owned and hired automobiles, trucks and trailers. Minimum acceptable limit is:
- | | |
|--------------------------------|-----------|
| Any one accident or loss | \$500,000 |
|--------------------------------|-----------|
- 9.3.4 For the portion of a project which is new construction, the Contractor shall procure and maintain Builder's Risk insurance naming the Owner, Contractor, and any Subcontractor as insureds as their interest may appear. Covered causes of loss form shall be all Risks of Direct Physical Loss, endorsed to include flood, earthquake, transit and sprinkler leakage where sprinkler coverage is applicable. Unless specifically authorized in writing by the Owner, the limit of insurance shall not be less than the initial contract amount, for the portion of the project which is new construction, and coverage shall apply during the entire contract period and until the work is accepted by the Owner.
- 9.3.5 The Contractor shall have Owner's Protective Liability insurance for contract values \$50,000 and above, naming the Owner as the Named Insured. Minimum acceptable limits are:
- | | |
|------------------------------|-------------|
| General aggregate limit..... | \$2,000,000 |
| Each occurrence limit..... | \$1,000,000 |

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10. Contract Bonds

- 10.1 When noted as required in the Bid Documents, the Contractor shall provide to the Owner a Performance Bond and a Payment Bond, or "contract bonds", upon execution of the contract. Each bond value shall be for the full amount of the contract and issued by a surety company authorized to do business in the State of Maine as approved by the Owner. The bonds shall be executed on the forms furnished in the Bid Documents. The bonds shall allow for any subsequent additions or deductions of the contract.
- 10.2 The contract bonds shall continue in effect for one year after final acceptance of the contract to protect the Owner's interest in connection with the one year guarantee of workmanship and materials and to assure settlement of claims for the payment of all bills for labor, materials and equipment by the Contractor.

11. Patents and Royalties

- 11.1 The Contractor shall, for all time, secure for the Owner the free and undisputed right to the use of any patented articles or methods used in the Work. The expense of defending any suits for infringement or alleged infringement of such patents shall be borne by the Contractor. Awards made regarding patent suits shall be paid by the Contractor. The Contractor shall hold the Owner harmless regarding patent suits that may arise due to installations made by the Contractor, and to any awards made as a result of such suits.
- 11.2 Any royalty payments related to the work done by the Contractor for the Project shall be borne by the Contractor. The Contractor shall hold the Owner harmless regarding any royalty payments that may arise due to installations made by the Contractor.

12. Surveys, Layout of Work

- 12.1 The Owner shall furnish all property surveys unless otherwise specified.
- 12.2 The Contractor is responsible for correctly staking out the Work on the site. The Contractor shall employ a competent surveyor to position all construction on the site. The surveyor shall run the axis lines, establish correct datum points and check each line and point on the site to insure their accuracy. All such lines and points shall be carefully preserved throughout the construction.
- 12.3 The Contractor shall lay out all work from dimensions given on the Drawings. The Contractor shall take measurements and verify dimensions of any existing work that affects the Work or to which the Work is to be fitted. The Contractor is solely responsible for the accuracy of all measurements. The Contractor shall verify all grades, lines, levels, elevations and dimensions shown on the Drawings and report any errors or inconsistencies to the Consultant prior to commencing work.

13. Record of Documents

- 13.1 The Contractor shall maintain one complete set of Contract Documents on the jobsite, in good order and current status, for access by the Owner and Consultant.
- 13.2 The Contractor shall maintain, continuously updated, complete records of Requests for Information, Architectural Supplemental Instructions (or equivalent), Information Bulletins,

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supplemental sketches, Change Order Proposals, Change Orders, Shop Drawings, testing reports, et cetera, for access by the Owner and Consultant.

14. Allowances

- 14.1 The Contract Price shall include all allowances described in the Contract Documents. The Contractor shall include all overhead and profit necessary to implement each allowance in their Contract Price.
- 14.2 The Contractor shall not be required to employ parties for allowance work against whom the Contractor has a reasonable objection. In such a case, the Contractor shall notify the Owner in writing of their position and shall propose an alternative party to complete the work of the allowance.

15. Shop Drawings

- 15.1 The Contractor shall administer Shop Drawings prepared by the Contractor, Subcontractors, suppliers or others to conform to the approved Schedule of the Work. The Contractor shall verify all field measurements, check and authorize all Shop Drawings and schedules required by the Work. The Contractor is the responsible party and contact for the Contractor's work as well as that of Subcontractors, suppliers or others who provide Shop Drawings.
- 15.2 The Consultant shall review and acknowledge Shop Drawings, with reasonable promptness, for general conformity with the design concept of the project and compliance with the information provided in the Contract Documents.
- 15.3 The Contractor shall provide monthly updated logs containing: requests for information, information bulletins, supplemental instructions, supplemental sketches, change order proposals, change orders, submittals, testing and deficiencies.
- 15.4 The Contractor shall make any corrections required by the Consultant, and shall submit a quantity of corrected copies as may be needed. The acceptance of Shop Drawings or schedules by the Consultant shall not relieve the Contractor from responsibility for deviations from Drawings and Specifications, unless the Contractor has called such deviations to the attention of the Consultant at the time of submission and secured the Consultant's written approval. The acceptance of Shop Drawings or schedules by the Consultant does not relieve the Contractor from responsibility for errors in Shop Drawings or schedules.

16. Samples

- 16.1 The Contractor shall furnish for approval, with reasonable promptness, all samples as directed by the Consultant. The Consultant shall review and approve such samples, with reasonable promptness, for general conformity with the design concept of the project and compliance with the information provided in the Contract Documents. The subsequent work shall be in accord with the approved samples.

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17. Substitutions

- 17.1 The Contractor shall furnish items and materials described in the Contract Documents. If the item or material specified describes a proprietary product, or uses the name of a manufacturer, the term “or approved equal” shall be implied, if it is not included in the text. The specific item or material specified establishes a minimum standard for the general design, level of quality, type, function, durability, efficiency, reliability, compatibility, warranty coverage, installation factors and required maintenance. The Drawing or written Specification shall not be construed to exclude other manufacturers products of comparable design, quality, and efficiency.
- 17.2 The Contractor may submit detailed information about a proposed substitution to the Consultant for consideration. Particular models of items and particular materials which the Contractor asserts to be equal to the items and materials identified in the Contract Documents shall be allowed only with written approval by the Consultant. The request for substitution shall include a cost comparison and a reason or reasons for the substitution.
- 17.3 The Consultant may request additional information about the proposed substitution. The approval or rejection of a proposed substitution may be based on timeliness of the request, source of the information, the considerations of minimum standards described above, or other considerations. The Consultant should briefly state the rationale for the decision. The decision shall be considered final.
- 17.4 The duration of a substitution review process can not be the basis for a claim for delay in the Schedule of the Work.

18. Assignment of Contract

- 18.1 The Contractor shall not assign or sublet the contract as a whole without the written consent of the Owner. The Contractor shall not assign any money due to the Contractor without the written consent of the Owner.

19. Separate Contracts

- 19.1 The Owner reserves the right to create other contracts in connection with this Project using similar General Conditions. The Contractor shall allow the Owner's other contractors reasonable opportunity for the delivery and storage of materials and the execution of their work. The Contractor shall coordinate and properly connect the Work of all contractors.
- 19.2 The Contractor shall promptly report to the Consultant and Owner any apparent deficiencies in work of the Owner's other contractors that impacts the proper execution or results of the Contractor. The Contractor's failure to observe or report any deficiencies constitutes an acceptance of the Owner's other contractors work as suitable for the interface of the Contractor's work, except for latent deficiencies in the Owner's other contractors work.
- 19.3 Similarly, the Contractor shall promptly report to the Consultant and Owner any apparent deficiencies in their own work that would impact the proper execution or results of the Owner's other contractors.

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- 19.4 The Contractor shall report to the Consultant and Owner any conflicts or claims for damages with the Owner's other contractors and settle such conflicts or claims for damages by mutual agreement or arbitration, if necessary, at no expense to the Owner.
- 19.5 In the event the Owner's other contractors sue the Owner regarding any damage alleged to have been caused by the Contractor, the Owner shall notify the Contractor, who shall defend such proceedings at the Contractor's expense. The Contractor shall pay or satisfy any judgment that may arise against the Owner, and pay all other costs incurred.

20. Subcontracts

- 20.1 The Contractor shall not subcontract any part of this contract without the written permission of the Owner.
- 20.2 The Contractor shall submit a complete list of named Subcontractors and material suppliers to the Consultant and Owner for approval by the Owner prior to commencing work. The Subcontractors named shall be reputable companies of recognized standing with a record of satisfactory work.
- 20.3 The Contractor shall not employ any Subcontractor or use any material until they have been approved, or where there is reason to believe the resulting work will not comply with the Contract Documents.
- 20.4 The Contractor, not the Owner, is as fully responsible for the acts and omissions of Subcontractors and of persons employed by them, as the Contractor is for the acts and omissions of persons directly or indirectly employed by the Contractor.
- 20.5 Neither the Contract Documents nor any Contractor-Subcontractor contract shall indicate, infer or create any direct contractual relationship between any Subcontractor and the Owner.

21. Contractor-Subcontractor Relationship

- 21.1 The Contractor shall be bound to the Subcontractor by all the obligations in the Contract Documents that bind the Contractor to the Owner.
- 21.2 The Contractor shall pay the Subcontractor, in proportion to the dollar value of the work completed and requisitioned by the Subcontractor, the approved dollar amount allowed to the Contractor no more than seven days after receipt of payment from the Owner.
- 21.3 The Contractor shall pay the Subcontractor accordingly if the Contract Documents or the subcontract provide for earlier or larger payments than described in the provision above.
- 21.4 The Contractor shall pay the Subcontractor for completed and requisitioned subcontract work, less retainage, no more than seven days after receipt of payment from the Owner for the Contractor's approved Requisition for Payment, even if the Consultant fails to certify a portion of the Requisition for Payment for a cause not the fault of the Subcontractor.
- 21.5 The Contractor shall not make a claim for liquidated damages or penalty for delay in any amount in excess of amounts that are specified by the subcontract.

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- 21.6 The Contractor shall not make a claim for services rendered or materials furnished by the Subcontractor unless written notice is given by the Contractor to the Subcontractor within ten calendar days of the day in which the claim originated.
- 21.7 The Contractor shall give the Subcontractor an opportunity to present and to submit evidence in any progress conference or disputes involving subcontract work.
- 21.8 The Contractor shall pay the Subcontractor a just share of any fire insurance payment received by the Contractor.
- 21.9 The Subcontractor shall be bound to the Contractor by the terms of the Contract Documents and assumes toward the Contractor all the obligations and responsibilities that the Contractor, by those documents, assumes toward the Owner.
- 21.10 The Subcontractor shall submit applications for payment to the Contractor in such reasonable time as to enable the Contractor to apply for payment as specified.
- 21.11 The Subcontractor shall make any claims for extra cost, extensions of time or damages, to the Contractor in the manner provided in these General Conditions for like claims by the Contractor to the Owner, except that the time for the Subcontractor to make claims for extra cost is seven calendar days after the receipt of Consultant's instructions.

22. Supervision of the Work

- 22.1 During all stages of the Work the Contractor shall have a competent superintendent, with any necessary assistant superintendents, overseeing the project. The superintendent shall not be reassigned without the consent of the Owner unless a superintendent ceases to be employed by the Contractor due to unsatisfactory performance.
- 22.2 The superintendent represents the Contractor on the jobsite. Directives given by the Consultant or Owner to the superintendent shall be as binding as if given directly to the Contractor's main office. All important directives shall be confirmed in writing to the Contractor. The Consultant and Owner are not responsible for the acts or omissions of the superintendent or assistant superintendents.
- 22.3 The Contractor shall provide supervision of the Work equal to the industry's highest standard of care. The superintendent shall carefully study and compare all Contract Documents and promptly report any error, inconsistency or omission discovered to the Consultant. The Contractor may not necessarily be held liable for damages resulting directly from any error, inconsistency or omission in the Contract Documents or other instructions by the Consultant that was not revealed by the superintendent in a timely way.

23. Observation of the Work

- 23.1 The Contractor shall allow the Owner, the Consultant and the Bureau continuous access to the site for the purpose of observation of the progress of the work. All necessary safeguards and accommodations for such observations shall be provided by the Contractor.

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- 23.2 The Contractor shall coordinate all required testing, approval or demonstration of the Work. The Contractor shall give sufficient notice to the appropriate parties of readiness for testing, inspection or examination.
- 23.3 The Contractor shall schedule inspections and obtain all required certificates of inspection for inspections by a party other than the Consultant.
- 23.4 The Consultant shall make all scheduled observations promptly, prior to the work being concealed or buried by the Contractor. If approval of the Work is required of the Consultant, the Contractor shall notify the Consultant of the construction schedule in this regard. Work concealed or buried prior to the Consultant's approval may need to be uncovered at the Contractor's expense.
- 23.5 The Consultant may order reexamination of questioned work, and, if so ordered, the work must be uncovered by the Contractor. If the work is found to conform to the Contract Documents, the Owner shall pay the expense of the reexamination and remedial work. If the work is found to not conform to the Contract Documents, the Contractor shall pay the expense, unless the defect in the work was caused by the Owner's Contractor, whose responsibility the reexamination expense becomes.
- 23.6 The Bureau shall periodically observe the Work during the course of construction and make recommendations to the Contractor or Consultant as necessary. Such recommendations shall be considered and implemented through the usual means for changes to the Work.
24. Consultant's Status
- 24.1 The Consultant represents the Owner during the construction period, and observes the work in progress on behalf of the Owner. The Consultant has authority to act on behalf of the Owner only to the extent expressly provided by the Contract Documents or otherwise demonstrated to the Contractor. The Consultant has authority to stop the work whenever such an action is necessary, in the Consultant's reasonable opinion, to ensure the proper execution of the contract.
- 24.2 The Consultant is the interpreter of the conditions of the contract and the judge of its performance. The Consultant shall favor neither the Owner nor the Contractor, but shall use the Consultant's powers under the contract to enforce faithful performance by both parties.
- 24.3 In the event of the termination of the Consultant's employment on the project prior to completion of the work, the Owner shall appoint a capable and reputable replacement. The status of the new Consultant relative to this contract shall be that of the former Consultant.
25. Management of the Premises
- 25.1 The Contractor shall place equipment and materials, and conduct activities on the premises in a manner that does not unreasonably hinder site circulation, environmental stability, or any long term effect. Likewise, the Consultant's directions shall not cause the use of premises to be impeded for the Contractor or Owner.

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- 25.2 The Contractor shall not use the premises for any purpose other than that which is directly related to the scope of work. The Owner shall not use the premises for any purpose incompatible with the proposed work simultaneous to the work of the Contractor.
- 25.3 The Contractor shall enforce the Consultant's instructions regarding information posted on the premises such as signage and advertisements, as well as activities conducted on the premises such as fires, and smoking.
- 25.4 The Owner may occupy any part of the Project that is completed with the written consent of the Contractor, and without prejudice to any of the rights of the Owner or Contractor. Such use or occupancy shall not, in and of itself, be construed as a final acceptance of any work or materials.

26. Safety and Security of the Premises

- 26.1 The Contractor shall designate, and make known to the Consultant and the Owner, a safety officer whose duty is the prevention of accidents on the site.
- 26.2 The Contractor shall continuously maintain security on the premises and protect from unreasonable occasion of injury all people authorized to be on the job site. The Contractor shall also effectively protect the property and adjacent properties from damage or loss.
- 26.3 The Contractor shall take all necessary precautions to ensure the safety of workers and others on and adjacent to the site, abiding by applicable local, state and federal safety regulations. The Contractor shall erect and continuously maintain safeguards for the protection of workers and others, and shall post signs and other warnings regarding hazards associated with the construction process, such as protruding fasteners, moving equipment, trenches and holes, scaffolding, window, door or stair openings, and falling materials.
- 26.4 The Contractor shall restore the premises to conditions that existed prior to the start of the project at areas not intended to be altered according to the Contract Documents.
- 26.5 The Contractor shall protect existing utilities and exercise care working in the vicinity of utilities shown in the Drawings and Specifications or otherwise located by the Contractor.
- 26.6 The Contractor shall protect from damage existing trees and other significant plantings and landscape features of the site which will remain a permanent part of the site. If necessary or indicated in the Contract Documents, tree trunks shall be boxed and barriers erected to prevent damage to tree branches or roots.
- 26.7 The Contractor shall repair or replace damage to the Work caused by the Contractor's or Subcontractor's forces, including that which is reasonably protected, at the expense of the responsible party.
- 26.8 The Contractor shall not load, or allow to be loaded, any part of the Project with a force which imperils personal or structural safety. The Consultant may consult with the Contractor on such means and methods of construction, however, the ultimate responsibility lies with the Contractor.
- 26.9 The Contractor shall not jeopardize any work in place with subsequent construction activities such as blasting, drilling, excavating, cutting, patching or altering work. The Consultant must

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approve altering any structural components of the project. The Contractor shall supervise all construction activities carried out by others on site to ensure that the work is neatly done and in a manner that will not endanger the structure or the component parts.

- 26.10 The Contractor may act with their sole discretion in emergency situations that potentially effect health, life or serious damage to the premises or adjacent properties, to prevent such potential loss or injury. The Contractor may negotiate with the Owner for compensation for expenses due to such emergency work.
- 26.11 The Contractor and Subcontractors shall have no responsibility for the identification, discovery, presence, handling, removal or disposal of, or exposure of persons to, hazardous materials in any form at the project site. The Contractor shall avoid disruption of any hazardous materials or toxic substances at the project site and promptly notify the Owner in writing on the occasion of such a discovery.
- 26.12 The Contractor shall keep the premises free of any unsafe accumulation of waste materials caused by the work. The Contractor shall regularly keep the spaces "broom clean". See the Close-out of the Work provisions of this section regarding cleaning at the completion of the project.

27. Changes in the Work

- 27.1 The Contractor shall not proceed with extra work without an approved Change Order or Construction Change Directive. A Change Order which has been properly signed by all parties shall become a part of the contract.
- 27.2 A Change Order is the usual document for directing changes in the Work. In certain circumstances, however, the Owner may utilize a Construction Change Directive to direct the Contractor to perform changes in the Work that are generally consistent with the scope of the project. The Owner shall use a Construction Change Directive only when the normal process for approving changes to the Work has failed to the detriment of the Project, or when agreement on the terms of a Change Order cannot be met, or when an urgent situation requires, in the Owner's judgment, prompt action by the Contractor.
- 27.3 The Consultant shall prepare the Construction Change Directive representing a complete scope of work, with proposed Contract Price and Contract Time revisions, if any, clearly stated.
- 27.4 The Contractor shall promptly carry out a Construction Change Directive which has been signed by the Owner and the Consultant. Work thus completed by the Contractor constitutes the basis for a Change Order. Changes in the Contract Price and Contract Time shall be as defined in the Construction Change Directive unless subsequently negotiated with some other terms.
- 27.5 The method of determining the dollar value of extra work shall be by:
- .1 an estimate of the Contractor accepted by Owner as a lump sum, or
 - .2 unit prices named in the contract or subsequently agreed upon, or
 - .3 cost plus a designated percentage, or
 - .4 cost plus a fixed fee.

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- 27.6 The Contractor shall determine the dollar value of the extra work for both the lump sum and cost plus designated percentage methods so as not to exceed the following rates. The rates include all overhead and profit expenses.
- .1 Contractor - for any work performed by the Contractor's own forces, up to 20% of the cost;
 - .2 Subcontractor - for work performed by Subcontractor's own forces, up to 20% of the cost;
 - .3 Contractor - for work performed by Contractor's Subcontractor, up to 10% of the amount due the Subcontractor.
- 27.7 The Contractor shall keep and provide records as needed or directed for the cost plus designated percentage method. The Consultant shall review and certify the appropriate amount which includes the Contractor's overhead and profit. The Owner shall make payments based on the Consultant's certificate.
- 27.8 Cost reflected in Change Orders shall be limited to the following: cost of materials, cost of delivery, cost of labor (including Social Security, pension, Workers' Compensation insurance, and unemployment insurance), and cost of rental of power tools and equipment. Labor cost may include a pro-ratio share of a foreman's time only in the case of an extension of contract time granted due to the Change Order.
- 27.9 Overhead reflected in Change Orders shall be limited to the following: bond premium, supervision, wages of clerks, time keepers, and watchmen, small tools, incidental expenses, general office expenses, and all other overhead expenses directly related to the Change Order.
- 27.10 The Contractor shall provide credit to the Owner for labor, materials, equipment and other costs but not overhead and profit expenses for those Change Order items that result in a net value of credit to the contract.
- 27.11 The Owner may change the scope of work of the Project without invalidating the contract. The Owner shall notify the Contractor of a change of the scope of work for the Owner's Contractors, which may affect the work of this Contractor, without invalidating the contract. Change Orders for extension of the time caused by such changes shall be developed at the time of directing the change in scope of work.
- 27.12 The Consultant may order minor changes in the Work, not involving extra cost, which is consistent with the intent of the design or project.
- 27.13 The Contractor shall immediately give written notification to the Consultant of latent conditions discovered at the site which materially differ from those represented in the Drawings or Specifications, and which may eventually result in a change in the scope of work. The Contractor shall suspend work until receiving direction from the Consultant. The Consultant shall promptly investigate the conditions and respond to the Contractor's notice with direction that avoids any unnecessary delay of the Work. The Consultant shall determine if the discovered conditions warrant a Change Order.
- 27.14 The Contractor shall, within ten calendar days of receipt of the information, give written notification to the Consultant if the Contractor claims that instructions by the Consultant will constitute extra cost not accounted for by Change Order or otherwise under the contract. The Consultant shall promptly respond to the Contractor's notice with direction that avoids any

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unnecessary delay of the Work. The Consultant shall determine if the Contractor's claim warrants a Change Order.

28. Correction of the Work

- 28.1 The Contractor shall promptly remove from the premises all work the Consultant declares is non-conforming to the contract. The Contractor shall replace the work properly at no expense to the Owner. The Contractor is also responsible for the expenses of others whose work was damaged or destroyed by such remedial work.
- 28.2 The Owner may elect to remove non-conforming work if it is not removed by the Contractor within a reasonable time, that time defined in a written notice from the Consultant. The Owner may elect to store removed non-conforming work not removed by the Contractor at the Contractor's expense. The Owner may, with ten days written notice, dispose of materials which the Contractor does not remove. The Owner may sell the materials and apply the net proceeds, after deducting all expenses, to the costs that should have been borne by the Contractor.
- 28.3 The Contractor shall remedy any defects due to faulty materials or workmanship and pay for any related damage to other work which appears within a period of one year from the date of substantial completion, and in accord with the terms of any guarantees provided in the contract. The Owner shall promptly give notice of observed defects to the Contractor and Consultant. The Consultant shall determine the status of all claimed defects. The Contractor shall perform all remedial work without unjustifiable delay in either the initial response or the corrective action.
- 28.4 The Consultant may authorize, after a reasonable notification to the Contractor, an equitable deduction from the contract amount in lieu of the Contractor correcting non-conforming or defective work.

29. Owner's Right to do Work

- 29.1 The Owner may, using other contractors, correct deficiencies attributable to the Contractor, or complete unfinished work. Such action shall take place only after giving the Contractor three days written notice, and provided the Consultant approves of the proposed course of action as an appropriate remedy. The Owner may then deduct the cost of the remedial work from the amount due the Contractor.
- 29.2 The Owner may act with their sole discretion when the Contractor is unable to take action in emergency situations that potentially effect health, life or serious damage to the premises or adjacent properties, to prevent such potential loss or injury. The Owner shall inform the Contractor of the emergency work performed, particularly where it may affect the work of the Contractor.

30. Termination of Contract and Stop Work Action

- 30.1 The Owner may, owing to a certificate of the Consultant indicating that sufficient cause exists to justify such action, without prejudice to any other right or remedy and after giving the Contractor and the Contractor's surety seven days written notice, terminate the employment of the

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Contractor. At that time the Owner may take possession of the premises and of all materials, tools and appliances on the premises and finish the work by whatever method the Owner may deem expedient. Cause for such action by the Owner includes:

- .1 the contractor is adjudged bankrupt, or makes a general assignment for the benefit of its creditors, or
- .2 a receiver is appointed due to the Contractor's insolvency, or
- .3 the Contractor persistently or repeatedly refuses or fails to provide enough properly skilled workers or proper materials, or
- .4 the Contractor fails to make prompt payment to Subcontractors or suppliers of materials or labor, or
- .5 the Contractor persistently disregards laws, ordinances or the instructions of the Consultant, or is otherwise found guilty of a substantial violation of a provision of the Contract Documents.

- 30.2 The Contractor is not entitled, as a consequence of the termination of the employment of the Contractor as described above, to receive any further payment until the Work is finished. If the unpaid balance of the contract amount exceeds the expense of finishing the Work, including compensation for additional architectural, managerial and administrative services, such balance shall be paid to the Contractor. If the expense of finishing the Work exceeds the unpaid balance, the Contractor shall pay the difference to the Owner. The Consultant shall certify the expense incurred by the Contractor's default. This obligation for payment shall continue to exist after termination of the contract.
- 30.3 The Contractor may, if the Work is stopped by order of any court or other public authority for a period of thirty consecutive days, and through no act or fault of the Contractor or of anyone employed by the Contractor, with seven days written notice to the Owner and the Consultant, terminate this contract. The Contractor may then recover from the Owner payment for all work executed, any proven loss and reasonable profit and damage.
- 30.4 The Contractor may, if the Consultant fails to issue a certificate for payment within seven days after the Contractor's formal request for payment, through no fault of the Contractor, or if the Owner fails to pay to the Contractor within 30 days after submission of any sum certified by the Consultant, with seven days written notice to the Owner and the Consultant, stop the Work or terminate this Contract.

31. Delays and Extension of Time

- 31.1 The completion date of the contract shall be extended if the work is delayed by changes ordered in the work which have approved time extensions, or by an act or neglect of the Owner, the Consultant, or the Owner's Contractor, or by strikes, lockouts, fire, flooding, unusual delay in transportation, unavoidable casualties, or by other causes beyond the Contractor's control. The Consultant shall determine the status of all claimed causes.
- 31.2 The contract shall not be extended for delay occurring more than seven calendar days before the Contractor's claim made in writing to the Consultant. In case of a continuing cause of delay, only one claim is necessary.
- 31.3 The contract shall not be extended due to failure of the Consultant to furnish drawings if no schedule or agreement is made between the Contractor and the Consultant indicating the dates

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which drawings shall be furnished and fourteen calendar days has passed after said date for such drawings.

- 31.4 This article does not exclude the recovery of damages for delay by either party under other provisions in the Contract Document.

32. Payments to the Contractor

- 32.1 As noted under *Preconstruction Conference* in this section, the Contractor shall submit a Schedule of Values form, before the first application for payment, for approval by the Owner and Consultant. The Consultant may direct the Contractor to provide evidence that supports the correctness of the form. The approved Schedule of Values shall be used as a basis for payments.
- 32.2 The Contractor shall submit an application for each payment ("Requisition for Payment") on a form approved by the Owner and Consultant. The Consultant may require receipts or other documents showing the Contractor's payments for materials and labor, including payments to Subcontractors.
- 32.3 The Contractor shall submit Requisitions for Payment as the work progresses not more frequently than once each month, unless the Owner approves a more frequent interval due to unusual circumstances. The Requisition for Payment is based on the proportionate quantities of the various classes of work completed or incorporated in the Work, in agreement with the actual progress of the Work and the dollar value indicated in the Schedule of Values.
- 32.4 The Consultant shall verify and certify each Requisition for Payment which appears to be complete and correct prior to payment being made by the Owner. The Consultant may certify an appropriate amount for materials not incorporated in the Work which have been delivered and suitably stored at the site. The Contractor shall submit bills of sale, insurance certificates, or other such documents that will adequately protect the Owner's interests prior to payments being certified.
- 32.5 In the event any materials delivered but not yet incorporated in the Work have been included in a certified Requisition for Payment with payment made, and said materials thereafter are damaged, deteriorated or destroyed, or for any reason whatsoever become unsuitable or unavailable for use in the Work, the full amount previously allowed shall be deducted from subsequent payments unless the Contractor satisfactorily replaces said material.
- 32.6 The Contractor may request certification of an appropriate dollar amount for materials not incorporated in the Work which have been delivered and suitably stored away from the site. The Contractor shall submit bills of sale, insurance certificates, right-of-entry documents or other such documents that will adequately protect the Owner's interests. The Consultant shall determine if the Contractor's documentation for the materials is complete and specifically designated for the Project. The Owner may allow certification of such payments.
- 32.7 Subcontractors may request, and shall receive from the Consultant, copies of approved Requisitions for Payment showing the amounts certified in the Schedule of Values.
- 32.8 Certified Requisitions for Payment, payments made to the Contractor, or partial or entire occupancy of the project by the Owner shall not constitute an acceptance of any work that does

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not conform to the Contract Documents. The making and acceptance of the final payment constitutes a waiver of all claims by the Owner, other than those arising from unsettled liens, from faulty work or materials appearing within one year from final payment or from requirements of the Drawings and Specifications, and of all claims by the Contractor, except those previously made and still unsettled.

33. Payments Withheld

- 33.1 The Owner shall retain five percent of each payment due the Contractor as part security for the fulfillment of the contract by the Contractor. The Owner may make payment of a portion of this “retainage” to the Contractor temporarily or permanently during the progress of the Work. The Owner may thereafter withhold further payments until the full amount of the five percent is reestablished. The Contractor may deposit with the Maine State Treasurer certain securities in place of retainage amounts due according to Maine Statute (5 M.R.S. §1746).
- 33.2 The Consultant may withhold or nullify the whole or a portion of any Requisitions for Payment submitted by the Contractor in the amount that may be necessary, in his reasonable opinion, to protect the Owner from loss due to any of the following:
- .1 defective work not remedied;
 - .2 claims filed or reasonable evidence indicating probable filing of claims;
 - .3 failure to make payments properly to Subcontractors or suppliers;
 - .4 a reasonable doubt that the contract can be completed for the balance then unpaid;
 - .5 liability for damage to another contractor.

The Owner shall make payment to the Contractor, in the amount withheld, when the above circumstances are removed.

34. Liens

- 34.1 The Contractor shall deliver to the Owner a complete release of all liens arising out of this contract before the final payment or any part of the retainage payment is released. The Contractor shall provide with the release of liens an affidavit asserting each release includes all labor and materials for which a lien could be filed. Alternately, the Contractor, in the event any Subcontractor or supplier refuses to furnish a release of lien in full, may furnish a bond satisfactory to the Owner, to indemnify the Owner against any lien.
- 34.2 In the event any lien remains unsatisfied after all payments to the Contractor are made by the Owner, the Contractor shall refund to the Owner all money that the latter may be compelled to pay in discharging such lien, including all cost and reasonable attorney’s fees.

35. Workmanship

- 35.1 The Contractor shall provide materials, equipment, and installed work equal to or better than the quality specified in the Contract Documents and approved in submittal and sample. The installation methods shall be of the highest standards, and the best obtainable from the respective trades. The Consultant’s decision on the quality of work shall be final.

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- 35.2 The Contractor shall know local labor conditions for skilled and unskilled labor in order to apply the labor appropriately to the Work. All labor shall be performed by individuals well skilled in their respective trades.
- 35.3 The Contractor shall perform all cutting, fitting, patching and placing of work in such a manner to allow subsequent work to fit properly, whether that be by the Contractor, the Owner's Contractors or others. The Owner and Consultant may advise the Contractor regarding such subsequent work. Notwithstanding the notification or knowledge of such subsequent work, the Contractor may be directed to comply with this standard of compatible construction by the Consultant at the Contractor's expense.
- 35.4 The Contractor shall request clarification or revision of any design work by the Consultant, prior to commencing that work, in a circumstance where the Contractor believes the work cannot feasibly be completed at the highest quality, or as indicated in the Contract Documents. The Consultant shall respond to such requests in a timely way, providing clarifying information, a feasible revision, or instruction allowing a reduced quality of work. The Contractor shall follow the direction of the Consultant regarding the required request for information.
- 35.5 The Contractor shall guarantee the Work against any defects in workmanship and materials for a period of one year commencing with the date of the Certificate of Substantial Completion, unless specified otherwise for specific elements of the project. The Work may also be subdivided in mutually agreed upon components, each defined by a separate Certificate of Substantial Completion.
36. Close-out of the Work
- 36.1 The Contractor shall remove from the premises all waste materials caused by the work. The Contractor shall make the spaces "broom clean" unless a more thorough cleaning is specified. The Contractor shall clean all windows and glass immediately prior to the final inspection, unless otherwise directed.
- 36.2 The Owner may conduct the cleaning of the premises where the Contractor, duly notified by the Consultant, fails to adequately complete the task. The expense of this cleaning may be deducted from the sum due to the Contractor.
- 36.3 The Contractor shall participate in all final inspections and acknowledge the documentation of unsatisfactory work, customarily called the "punch list", to be corrected by the Contractor. The Consultant shall document the successful completion of the Work in a dated Certificate of Substantial Completion, to be signed by Owner, Consultant, and Contractor.
- 36.4 The Contractor shall not call for final inspection of any portion of the Work that is not completely and permanently installed. The Contractor may be found liable for the expenses of individuals called to final inspection meetings prematurely.
- 36.5 The Contractor and all major Subcontractors shall participate in the end-of-warranty-period conference, typically scheduled close to one year after the Substantial Completion date.

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37. Date of Completion and Liquidated Damages

- 37.1 The Contractor may make a written request to the Owner for an extension or reduction of time, if necessary. The request shall include the reasons the Contractor believes justifies the proposed completion date. The Owner may grant the revision of the contract completion date if the Work was delayed due to conditions beyond the control and the responsibility of the Contractor. The Contractor shall not conduct unauthorized accelerated work or file delay claims to recover alleged damages for unauthorized early completion.
- 37.2 The Contractor shall vigorously pursue the completion of the Work and notify the Owner of any factors that have, may, or will affect the approved Schedule of the Work. The Contractor may be found responsible for expenses of the Owner or Consultant if the Contractor fails to make notification of project delays.
- 37.3 The Project is planned to be done in an orderly fashion which allows for an iterative submittal review process, construction administration including minor changes in the Work and some bad weather. The Contractor shall not file delay claims to recover alleged damages on work the Consultant determines has followed the expected rate of progress.
- 37.4 The Consultant shall prepare the Certificate of Substantial Completion which, when signed by the Owner and the Contractor, documents the date of Substantial Completion of the Work or a designated portion of the Work. The Owner shall not consider the issuance of a Certificate of Occupancy by an outside authority a prerequisite for Substantial Completion if the Certificate of Occupancy cannot be obtained due to factors beyond the Contractor's control.
- 37.5 Liquidated Damages may be deducted from the sum due to the Contractor for each calendar day that the Work remains uncompleted after the completion date specified in the Contract or an approved amended completion date. The dollar amount per day shall be calculated using the Schedule of Liquidated Damages table shown below.

If the original contract amount is:	The per day Liquidated Damages shall be:
Less than \$100,000	\$250
\$100,000 to less than \$2,000,000	\$750
\$2,000,000 to less than \$10,000,000	\$1,500
\$10,000,000 and greater	\$1,500 plus \$250 for each \$2,000,000 over \$10,000,000

38. Dispute Resolution

38.1 Mediation

- 38.1.1 A dispute between the parties which arises under this Contract which cannot be resolved through informal negotiation, shall be submitted to a neutral mediator jointly selected by the parties.
- 38.1.2 Either party may file suit before or during mediation if the party, in good faith, deems it to be necessary to avoid losing the right to sue due to a statute of limitations. If suit is filed before good faith mediation efforts are completed, the party filing suit shall agree to stay all proceedings in the lawsuit pending completion of the mediation process, provided such stay is without prejudice.

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38.1.3 In any mediation between the Owner and the Consultant, the Owner has the right to consolidate related claims between Owner and Contractor.

38.2 Arbitration

38.2.1 If the dispute is not resolved through mediation, the dispute shall be settled by arbitration. The arbitration shall be conducted before a panel of three arbitrators. Each party shall select one arbitrator; the third arbitrator shall be appointed by the arbitrators selected by the parties. The arbitration shall be conducted in accordance with the Maine Uniform Arbitration Act (MUAA), except as otherwise provided in this section.

38.2.2 The decision of the arbitrators shall be final and binding upon all parties. The decision may be entered in court as provided in the MUAA.

38.2.3 The costs of the arbitration, including the arbitrators' fees shall be borne equally by the parties to the arbitration, unless the arbitrator orders otherwise.

38.2.4 In any arbitration between the Owner and the Consultant, the Owner has the right to consolidate related claims between Owner and Contractor.

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Wage Determination Schedule

PART 1- GENERAL

1.1 Related Documents

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

1.2 Summary

- A. This Section includes the wage determination requirements for Contractors as issued by the State of Maine Department of Labor Bureau of Labor Standards or the United States Department of Labor.

1.3 Requirements

- A. Conform to the wage determination schedule for this project which is shown on the following page.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

00 73 46
Wage Determination Schedule

SEE FOLLOWING PAGE

End of Section 00 73 46

State of Maine
Department of Labor
Bureau of Labor Standards
Augusta, Maine 04333-0045
Telephone (207) 623-7906

Wage Determination - In accordance with 26 MRS §1301 et. seq., this is a determination by the Bureau of Labor Standards, of the fair minimum wage rate to be paid to laborers and workers employed on the below titled project.

2026 Fair Minimum Wage Rates – Building 2 Cumberland County (other than 1 or 2 family homes)

Occupational Title	Minimum Wage	Minimum Benefit	Total
Brickmasons and Blockmasons	\$43.91	\$11.02	\$54.93
Bulldozer Operator	\$30.62	\$5.38	\$36.00
Carpenter	\$30.01	\$19.69	\$49.70
Cement Masons and Concrete Finisher	\$45.38	\$34.84	\$80.22
Construction and Maintenance Painters	\$26.23	\$2.81	\$29.04
Construction Laborer	\$21.90	\$19.72	\$41.62
Conveyor Operators and Tenders	\$30.17	\$13.77	\$43.94
Crane and Tower Operators	\$40.43	\$8.63	\$49.06
Crushing Grinding and Polishing Machine Operators	\$26.15	\$3.24	\$29.39
Earth Drillers - Except Oil and Gas	\$25.04	\$3.77	\$28.81
Electrical Power - Line Installer and Repairers	\$48.12	\$15.63	\$63.75
Electricians	\$38.75	\$21.52	\$60.27
Elevator Installers and Repairers	\$72.19	\$44.52	\$116.71
Excavator Operator	\$31.75	\$5.53	\$37.28
Fence Erectors	\$26.69	\$3.29	\$29.98
Flaggers	\$21.39	\$0.86	\$22.25
Floor Layers - Except Carpet/Wood/Hard Tiles	\$29.00	\$8.65	\$37.65
Glaziers	\$39.32	\$19.22	\$58.54
Hazardous Materials Removal Workers	\$25.01	\$2.04	\$27.05
Heating and Air Conditioning and Refrigeration Mechanics and Installers	\$36.11	\$6.39	\$42.50
Heavy and Tractor - Trailer Truck Drivers	\$26.10	\$4.07	\$30.17
Highway Maintenance Workers	\$23.30	\$1.14	\$24.44
Industrial Machinery Mechanics	\$29.97	\$6.74	\$36.71
Industrial Truck and Tractor Operators	\$24.61	\$4.21	\$28.82
Insulation Worker - Mechanical	\$28.57	\$17.06	\$45.63
Light Truck or Delivery Services Drivers	\$26.79	\$5.14	\$31.93
Loading Machine and Dragline Operators	\$26.99	\$5.12	\$32.11
Millwrights	\$35.99	\$10.52	\$46.51
Mobile Heavy Equipment Mechanics - Except Engines	\$26.43	\$5.48	\$31.91
Operating Engineers and Other Equipment Operators	\$47.25	\$31.30	\$78.55
Paving Surfacing and Tamping Equipment Operators	\$30.74	\$10.67	\$41.41
Pile-Driver Operators	\$37.15	\$3.12	\$40.27
Pipe/Steam/Sprinkler Fitter	\$43.76	\$25.44	\$69.20
Pipelayers	\$28.75	\$3.64	\$32.39
Plumbers	\$40.00	\$24.71	\$64.71
Radio Cellular and Tower Equipment Installers	\$34.72	\$5.63	\$40.35
Reinforcing Iron and Rebar Workers	\$48.19	\$1.93	\$50.12
Riggers	\$32.94	\$25.00	\$57.94
Roofers	\$28.42	\$4.56	\$32.98
Sheet Metal Workers	\$30.18	\$6.64	\$36.82
Structural Iron and Steel Workers	\$27.16	\$21.25	\$48.41
Tapers	\$31.43	\$5.47	\$36.90
Telecommunications Equipment Installers and Repairers - Except Line Installers	\$32.28	\$14.53	\$46.81
Telecommunications Line Installers and Repairers	\$34.84	\$17.48	\$52.32
Tile and Marble Setters	\$28.91	\$5.46	\$34.37

Welders are classified as the trade to which welding is incidental (e.g. welding structural steel is Structural Iron and Steel Worker)

Apprentices – The minimum wage rates for registered apprentices are the rates recognized in the sponsorship agreement for registered apprentices working in the pertinent classification.

For any other specific trade on this project not listed above, contact the Bureau of Labor Standards for further clarification.

Title 26 §1310 requires that a clearly legible statement of all fair minimum wage and benefits rates to be paid the several classes of laborers, workers and mechanics employed on the construction on the public work must be kept posted in a prominent and easily accessible place at the site by each contractor and subcontractor subject to sections 1304 to 1313.

Appeal – Any person affected by the determination of these rates may appeal to the Commissioner of Labor by filing a written notice with the Commissioner stating the specific grounds of the objection within ten (10) days from the filing of these rates.

A true copy

Attest: 
Scott R. Cotnoir
Wage & Hour Director
Bureau of Labor Standards

Supersedes 02-03-2025
Effective 01-10-2026

SECTION 01 00 00
GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The General Conditions, Supplementary General Conditions and Special Conditions of this Contract shall apply to each and every contract and contractor or other person or persons supplying labor, material, equipment and/or services entering into this Project and/or on the premises directly or indirectly.
- B. Definitions:
 - 1. The word "Contractor" where used throughout this document to describe the General Contractor, shall also mean the "Construction Manager", both Contractor and Construction Manager describing the entity holding the prime Contract for Construction.
- C. Work Included in This Contract:
 - 1. Providing all labor, materials, equipment, and services, etc., as required to properly complete all Work identified in, implied by or otherwise required by the Contract Documents.
- D. Work Excluded from This Contract:
 - 1. Providing equipment noted as "Not in Contract" (N.I.C.) or "By Owner," (B.O.). The Contractor shall, however, provide services and coordination related to items not in the Contract as otherwise required or implied by the Contract Documents.

1.02 GENERAL RESPONSIBILITIES OF THE CONTRACTOR

- A. Regulations: The Contractor shall fully comply with all governing Local, State and Federal Laws, Codes, Rules, Regulations and Ordinances, including but not limited to The Americans with Disabilities Act, Equal Employment Opportunity and Affirmative Action provisions, and Occupational Safety and Health Administration provisions.
- B. Permits: The Contractor shall obtain and pay for all permits and arrange for necessary inspections and approvals from the authorities having jurisdiction. Should any changes be necessary in the Contract Documents to secure such approvals, the Contractor shall promptly notify the Architect.
 - 1. For the Owner's records, submit copies of permits, licenses, inspection reports, certifications, and similar documents, correspondence and records established in conjunction with compliance with standards and regulations bearing on the Work.
- C. Coordination: The Contractor shall be fully responsible for coordinating all construction activities to assure efficient and orderly installation of each part of the Work. In general coordination duties shall include, but not be limited to verifying dimensions and existing field conditions, coordinating construction operations, establishing on-site lines of authority and communication, monitoring schedules and progress, monitoring quality, maintaining records and reports and in general assuring the proper administration of the Work.
 - 1. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
 - 2. Where installation of a component or system involves installation of component parts by multiple subcontractors, the Contractor shall inventory, store, and distribute parts to appropriate installers.
 - 3. Where structural, electrical, or mechanical components such as columns, ductwork, sprinkler piping, or raceways are installed in finished spaces, the intent is for room finish to enclose such components unless indicated otherwise. Coordinate between the trades and with the Architect.

4. Where inspections or approval of a substrate or component to be concealed by another is required, coordinate construction activities and notification of Architect or inspecting party. Do not conceal substrate or component until it has been inspected and is satisfactory.
 5. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for maintenance, service, and repair.
 6. Make adequate provision to accommodate items scheduled for later installation.
 7. Coordinate completion and clean-up of Work in preparation of Substantial Completion.
 8. After Owner occupancy, coordinate access to site for correction of defective or incomplete Work to minimize disruptions to Owner's activities.
- D. Supervision – Construction Superintendent: The Contractor shall place and maintain a competent, experienced construction Superintendent/Foreman in charge of the Work on the job site at all times while work is in progress, including overtime operations by the Contractor's forces or by subcontractors. No changes in this position shall be made without the Owner's prior approval. The Owner shall have the right to review the qualifications of the proposed Superintendent/Foreman and ask for a replacement if in his opinion the person does not meet the qualifications that the project will demand. The same superintendent who was in charge during the general progress of the Work shall oversee the completion of all punch list items.
1. The Contractor shall be responsible for the strict enforcement of the following requirements:
 - a. All persons working on the Project site shall be required to conduct themselves in a courteous and professional manner. The use of profane language shall be strictly prohibited.
 - b. Smoking and alcoholic beverages shall be strictly prohibited on the Project site.
 - c. The use of radios, etc. shall be strictly regulated if they interfere with the Owner's ongoing building operation.
 - d. Contact with building occupants and visitors shall be minimized to the extent necessary for the safe and proper execution of the Work.
 - e. All construction personnel shall be issued identification badges by the Contractor, which shall be conspicuously displayed at all times while on the construction site.
- E. On-Site Documents: The Contractor shall provide in a visible and accessible location in the on-site office:
1. Complete, currently updated set of Specifications and Drawings, Change Orders, reviewed Shop Drawings, and other documents and samples.
 2. Permits and notifications required by laws and regulations.
 3. Standards, manuals, installation instructions, or reports required by individual Specification sections.
 4. Product MSDS Sheets.
 5. List of Owner, Owner's Representative, Architect, Architect's Consultants, Contractor's project manager, superintendent, assistant superintendent, subcontractors, building inspector, police, ambulance and fire departments; include telephone numbers and fax numbers.
 6. Complete Copy of all background checks for on-site personnel.
- F. Accommodation and Cooperation with the Owner: The Contractor shall cooperate with the Owner to the greatest extent possible. Disruptions and inconveniences to the activities of existing facilities to remain in operation during construction shall be minimized and shall be subject to the prior approval of the Owner. The Contractor's cooperative efforts shall include, but shall not necessarily be limited to:
1. Maintaining fire and all other safety standards acceptable to governing authorities.
 2. Protecting existing building construction, landscaping, site utilities, site improvements and features, and all other improvements within and about the project area. See Division 2 for more information.
 3. Obtaining abutters' written authorization to conduct construction related activities on their properties, if required. NOTE: The Contractor shall obtain permits and approvals required to temporarily alter or obstruct sidewalks and street(s) if required.

4. Storing on-site materials at locations acceptable to the Owner and governing authorities.
 5. Controlling construction staging, parking, and traffic and limiting it to areas acceptable to the Owner and governing authorities.
 6. Providing access for and cooperating with other contractors to be employed by the Owner.
 7. Providing access for and cooperating with equipment and furnishing suppliers/installers (including the Owner's own forces) to be employed by the Owner.
 8. Accommodating existing occupants and other ongoing activities within and about the Project. Such accommodations shall include, but shall not necessarily be limited to:
 - a. Maintaining safe egress acceptable to governing authorities.
 - b. Maintaining adequate heating, air conditioning, and ventilation.
 - c. Maintaining fire suppression system.
 - d. Maintaining electrical power, fire alarm, and detection systems, sound systems, clock systems, intrusion detection systems, television, computer, and telephone services.
 - e. Maintaining special systems and services such as emergency electrical power.
 - f. Maintaining suitable toilet and janitorial facilities.
 - g. Maintaining a watertight roof.
 - h. Providing adequate dirt, dust, fume, vapor, and noise control. NOTE: The Contractor shall take special precautions to prevent the introduction of construction related dust, fumes, vapors, etc. from entering into HVAC system ducts, return air grilles, fresh air intakes, etc.)
 - i. Providing temporary fire and smoke partitions acceptable to governing authorities.
 - j. Providing adequate building security in areas under the Contractor's control.
- G. Phasing and Work Scheduling
1. The following shall serve as a general description of the Owner's scheduling requirements related to the Work of this Contract. It is provided for the Contractor's use in preparing an acceptable schedule and executing the Work at times and in a manner least disruptive to ongoing activities.

Prior to completing and distributing the Construction Schedule or proceeding with the Work, the Contractor shall meet with the Owner, accurately assess the Owner's requirements relative to the use of existing facilities and schedule the Work accordingly.

 - a. All subcontractors shall coordinate with the Contractor to determine all phasing and sequencing requirements and to schedule the Work. Work shall be executed in such a manner that shall cause minimal or no disruptions of the Owner's activities and the activities of other trades.
 - b. Coordinate all deliveries, installation, etc, as required to avoid Owner disruption and/or inconvenience.
 - c. Partial and/or phased occupancy of the facility shall require systems start-ups, tests, balancing, and other similar activities to occur at the completion of each portion of the Project, instead of exclusively at the completion of the entire Project. If system adjustments cannot be properly done until completion of the entire system, interim or temporary adjustments shall be provided for proper system operation and occupant comfort in occupied areas.
 - d. See Section 01 78 10 - Warranties for requirements regarding extended warranties for equipment serving phased occupancy.
- H. Safety: The Contractor shall assume full responsibility for all means, methods, procedures, sequences and techniques of construction employed and shall take all measures required to ensure the safety of construction workers, as well as the safety of the general public. The Contractor shall take into full consideration and assure himself that all necessary barricades, and shoring are provided and that they comply with applicable regulations and standards of good practice. The public shall be guarded from all construction hazards and/or attractive nuisances. The Contractor shall pay all costs necessary for temporary partitioning, barricading, fencing, shoring, walks, ramps, enclosures, flashing lights, warning signs, security and safety devices required for the maintenance of a clean and safe construction site.

1. Owner's Safety Policies: Prior to the commencement of construction, the Contractor shall thoroughly review the Owner's facility and occupant safety policies and procedures and shall inform all construction workers of their related responsibilities. Should the Contractor take exception to any of the Owner's policies and procedures, he shall so notify the Owner and Architect, in writing, prior to proceeding with the Work. The failure to provide such notification shall be construed as full acceptance of the Owner's policies and procedures.
 2. MSDS Sheets: The Contractor shall furnish copies of Material Safety Data Sheets to the Owner for all materials classified as hazardous or poisonous. MSDS for all materials shall be maintained with the Contractor in a file on-site.
- I. Indoor Air Quality Management:
1. The Contractor and his various subcontractors as he may direct shall implement procedures throughout construction in an effort to improve indoor air quality during the Owner's occupancy. See Section 01 57 21- Indoor Air Quality Controls.
 2. The maintenance of a clean, dust-free environment in areas of the facility that remain operational or otherwise accessible to non-construction personnel shall be the shared responsibility of all construction personnel.
 3. Control of dust, vapors, odors, and the spread of fire shall be considered of paramount importance. Unless otherwise specifically required by the Owner, the means and methods of achieving such control shall remain the exclusive responsibility of the Contractor, and not the Owner or Architect. However, the following may be considered:
 - a. Construction of non-combustible partitions and enclosures.
 - b. Negative pressure containment.
 - c. Duct tape and sealant.
 - d. Walk-off mats (adhesive treated).
 - e. Vacuuming (with HEPA filtered vacuum).
 - f. Closure of air intake vents (verify need for service prior to interruption).
 4. The Contractor and his various subcontractors as he may direct shall implement the following procedures in an effort to improve indoor air quality during the Owner's occupancy:
 - a. All adhesives (for construction, floor and wall coverings, etc.), paints, thinners, solvents, etc. shall, among other technical qualifications, be selected in consideration of minimizing their potential contribution to indoor air pollution. All "wet" products (i.e. paint, sealers, and other liquid products), to the greatest extent possible, shall be installed before ceiling tile and carpet to minimize emissions interaction between building products.
 - b. Provide maximum all-outside-air ventilation during the installation of strong emitting materials. This shall be done for the purpose of reducing the contamination of other materials by absorption of solvents and other volatile components.
 - c. On projects where the Owner (or other user) occupies all or portions of the building during construction, the Contractor shall make every practical effort to minimize their exposure to fumes and dust from construction. Such efforts shall include items 1 through 3 above, as well as the construction of temporary air-tight barriers, maintaining negative air pressure in work areas, isolation of ventilation systems and all other appropriate means as determined by the Contractor.
- J. Environmental Regulations: The Contractor shall comply with all applicable environmental laws and regulations. Particular attention shall be paid to proper dust, fume and vapor control throughout the building and site.
- K. Hazardous Substances: The Architect's Scope of Services and responsibilities exclude the investigation, discovery, detection, identification, presence, leakage, release, use, handling, disposal, encapsulation, abatement, treatment, or removal of, or exposure of a person or persons to hazardous materials, pollutants, contaminants, or disease transmitting organisms, pre-existing or otherwise deposited in any form at the project, indoors or outdoors, at any time before, during or after construction, including but not limited to volatile organic compounds, petroleum products, bacteria, molds, fungus, asbestos or asbestos products, lead, radon,

electro-magnetic frequency radiation or other radiation. Should any such substances be encountered, the Owner and Architect shall be promptly notified, in writing.

- L. Layout and Field Engineering: The Contractor shall be responsible for all layout of all Work, even if such layout is done by others. The Contractor's responsibility includes but is not necessarily limited to levels, control points, base lines, reference points, locations of components, fixtures, equipment, finishes, etc.
 - 1. The existence and location of utilities and construction indicated as existing are not guaranteed.
 - 2. The Contractor shall carefully examine all buildings, sites, and Contract Documents prior to submitting his Bid and satisfy himself as to the conditions under which he must operate to perform the Work. No additional compensation will be made to the Contractor for any error or negligence on his part, nor for discrepancies between actual conditions found at the buildings and sites and as indicated in the Contract Documents, unless such discrepancies are brought to the attention of the Architect by a Bidder or Sub-Bidder, in writing, prior to the opening of Bids.
- M. Protection of Adjoining Property: The Contractor shall provide all shoring, fencing, and other work necessary to support, protect and keep unharmed all walls, footings, floors, roofs, walks, roadways and all other parts of any existing buildings, facilities, site improvements, landforms, trees and plant materials, etc. The Contractor shall hold the Owner and Architect harmless from any such damage due to any operations under this Contract. Any existing work or property damaged or disrupted as a result of this Contract shall be replaced or repaired to match original existing conditions at no additional cost to the Owner.
- N. Traffic Regulations and Parking: The Contractor shall properly regulate traffic at times when the Work interferes with the normal flow of traffic both on and off the site. Parking for workers on the project shall be limited to areas designated by the Owner or governing officials. Roadways and driveways outside the limits of the Contract shall be kept free of debris resulting from construction related traffic.
- O. Roads and Access to the Site: Access to the site for workers and the delivery or removal of construction materials and/or equipment shall be made only from locations approved by governing authorities and acceptable to the Owner. Existing roads, lanes and other required fire access shall remain accessible to fire vehicles at all times. Hauling permits and route approvals shall be obtained from governing authorities as applicable.
- P. Security: The Contractor shall be responsible for the securing of Work Areas against the entry of unauthorized persons at all times, including nights, holidays and days when the buildings may be unoccupied.
 - 1. When construction related personnel are the last to leave the Facility, they shall verify that the entire building perimeter is properly secured.
 - 2. When non-construction related personnel are the last to leave the facility, the Contractor shall verify that all work areas are properly secured.
- Q. Permanent Fire Protection: At the earliest feasible date in each area of the Project, complete installation of permanent fire protection facilities, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
- R. Snow Removal: The Construction Manager shall be responsible for snow and ice removal within designated staging and contractor storage & lay-down areas.
- S. Vandalism: The Contractor shall take all reasonable precautions necessary to prevent loss or damage caused by vandalism, theft, burglary, pilferage, or unexplained disappearance of property of the Owner, whether or not forming part of the Work, located within those areas of the Project to which the Contractor has access.
- T. Existing Materials and Equipment: See Section 01 60 00 - Product Requirements.
- U. Shipping and Storage of Materials: See Section 01 60 00 - Product Requirements.
- V. Owner Furnished Equipment: See Section 01 60 00 - Product Requirements.

- W. Watertight Structure: The Contract Documents are not intended to depict each and every condition or detail of construction. As the knowledgeable party in the field, the Contractor is in the best position to verify that all construction is completed in a manner that will provide a watertight structure during construction (i.e. as needed to keep all interior construction dry both during and following its installation) and upon completion of construction. The Contractor shall be solely responsible for ensuring the watertight integrity of the structure.
- X. Guarantee: The Contractor shall guarantee the entire Work to be free from defective or improper work or materials and shall make good any damage due to such work or materials for a term of one year from the date of the satisfactory completion and acceptance of the Work. See Section 01 78 10 - Warranties.

1.03 MEASUREMENT AND PAYMENT

- A. Schedule of Values: Submit a preliminary sample of the Schedule of Values for review and comment regarding format and content to the Architect at the earliest feasible date, but in no case later than fourteen (14) days prior to submittal of the first Application for Payment. The Schedule of Values shall clearly identify the cost of the Work by trade, plus all General Conditions, Allowances, and accepted Alternates.
 - 1. The format and general content of such schedule shall be acceptable to the Owner and Architect.
 - a. Round amount off to the nearest whole dollar; the total shall equal the Contract Sum.
 - b. No later than seven (7) days prior to submittal of the first Application for Payment, the Contractor shall submit to the Architect and Owner, the fully completed Schedule of Values.
- B. Payment Requisition: The Contractor shall submit to the Architect three original copies of "Application for Payment", AIA Forms G702 and G703, an itemized statement showing the original Contract Amount, the value of the Work to date, the amount previously approved, the amount presently requested and the balance remaining. Each copy shall be fully executed and properly signed and sealed.
 - 1. Application for Payment entries shall match the Schedule of Values. Include amounts of Change Orders issued prior to the last day of the construction period covered by the application.
 - 2. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and paid for by the Owner.
 - 3. Progress payment dates shall be as established elsewhere in the Agreement. The Contractor shall submit a draft of the Application for Payment to the Architect sufficiently in advance of the due date to the Architect to allow for preliminary review and adjustments.
 - 4. The Contractor shall clearly differentiate between items stored on-site and items stored off-site. For off-site stored materials, provide invoices, list of materials, insurance certificate, right of entry, transfer of title, and other documents as may be required by the Architect and Owner.
 - 5. Provide invoices, vouchers, time sheets, and other documents as may be required by the Architect to verify labor and materials costs.
 - 6. Each Application for Payment shall be accompanied by a transmittal listing all attachments.
 - 7. Initial Application for Payment: The following administrative actions and submittals shall precede or coincide with the submittal of the first Application for Payment:
 - a. List of subcontractors, principal suppliers, and fabricators.
 - b. Schedule of Values.
 - c. Contractor's Construction Schedule (preliminary, if not final).
 - d. Contractor's Submittal Schedule (preliminary, if not final).
 - e. List of Contractor's staff assignments.
 - f. Copies of building permits, authorizations, and licenses from governing authorities.
 - g. Certificates of insurance.
 - h. Data needed to acquire Owner's insurance.
 - i. Initial Progress Report.

- j. Performance and Payment Bonds, if applicable.
- k. Estimated payment schedule for duration of the Project.
- 8. Application for Payment at Substantial Completion: Submit an Application for Payment following issuance of the Certificate of Substantial Completion. The application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work. See AIA 201 General Conditions of the Contract. The following administrative actions and submittals shall precede or coincide with the submittal of this Application for Payment:
 - a. Occupancy permits, as applicable.
 - b. Warranties and maintenance agreements.
 - c. Testing / adjusting / balancing reports.
 - d. Maintenance instructions.
 - e. Meter readings, as applicable.
 - f. Start-up performance reports.
 - g. Change-over information related to Owner's occupancy, use operation and maintenance.
 - h. Final cleaning.
 - i. Application for reduction of retainage, and consent of surety.
 - j. Advice on shifting insurance coverage.
 - k. List of incomplete Work, recognized as exception to the Architect's Certificate of Substantial Completion, if any.
- 9. Final Application for Payment: This application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work. See Article regarding Final Payment of the Agreement and AIA 201 General Conditions of the Contract. The following administrative actions and submittals shall precede or coincide with the submittal of the final Application for Payment:
 - a. All items required by Article 9 "Payments & Completion" of AIA A201.
 - b. Completion of Project close-out requirements.
 - c. Completion of items specified for completion after Substantial Completion.
 - d. Assurance that unsettled claims will be settled.
 - e. Transmittal of required Project construction records, including Record Drawings to the Owner.
 - f. Proof that taxes, fees and similar obligations have been paid.
 - g. Removal of temporary facilities and services.
 - h. Removal of surplus materials, rubbish, and similar elements.
- C. Waivers of Mechanics Lien: With each Application for Payment, submit waivers of mechanics lien for every entity who is lawfully entitled to file a lien arising out the Contract and related to the Work covered by the Payment. See AIA A201 General Conditions of the Contract.
 - 1. The Contractor shall promptly execute a partial waiver of mechanics lien for the period of construction covered by each application. Executed waivers shall be submitted to the Architect with the submittal of the next Application for Payment by the Contractor. With each Application for Payment, submit partial waiver of mechanics liens from subcontractors, or sub-subcontractors and suppliers for the construction period covered by the previous application.
 - 2. When an application shows completion of an item, submit final or full waivers when retainage is released.
 - 3. The Owner reserves the right to designate which entities involved in the Work must submit waivers.
 - 4. Submit the final Application for Payment with or preceded by final waivers from every entity involved with the performance of the Work covered by the application who could lawfully be entitled to a lien. The total amount of each entity's final waiver of lien shall equal the Contract Sum for that entity including all additions and reductions thereto.
 - 5. Submit waiver of liens on the following forms, and executed in a manner, acceptable to the Owner:

- a. Partial waiver of liens: Form provided by the Contractor and acceptable to the Architect and Owner.
 - b. Final waiver of liens: AIA G706A Contractor's Affidavit of Payment of Release of Liens or another form acceptable to the Architect and Owner.
- D. Schedule Update: Along with each payment requisition, the Contractor shall submit construction photographs and a report on the status of the next month's construction schedule. Each such monthly report shall update the progress of the Work and shall identify:
1. Areas of the building and site expected to be worked on during the next month.
 2. Special conditions or circumstances that may affect the safe use of the building or site.

1.04 MODIFICATION PROCEDURES

- A. Minor Changes to the Work: Supplemental Instructions, authorizing minor changes in the Work, not involving an adjustment to the Contract Sum or Contract Time, may be issued by the Architect.
- B. Architect / Owner Initiated Change Order Proposal Requests: The Architect shall issue Proposal Requests that describe proposed changes in the Work that may require adjustment to the Contract Sum and/or Contract Time. The Architect will provide supplemental sketches or revised Drawings and Specifications as necessary.
 1. Proposal requests are for information only. Do not consider them an instruction either to stop work in progress, or to execute the proposed change.
 2. Unless otherwise indicated in the proposal request, within ten working days of receipt of the proposal request, the Contractor shall submit to the Architect and Owner for review, an estimate of cost necessary to execute the proposed change. Include an itemization of quantities, unit costs, etc. Include all related charges and a statement indicating the effect the proposed change will have on the Contract Time.
- C. Contractor Initiated Change Order Proposal Requests: The Contractor may propose changes when latent or other unforeseen conditions require modifications to the Contract, by submitting a request for a change to the Architect.
 1. Provide a complete description of the proposed change. Indicate the reason for the change and the effect of the change on the Work, the Contract Sum and the Contract Time. Include an itemization of quantities, unit costs, etc. and include all related charges. Comply with requirements for "Substitutions".
- D. Allowances: See Section 01 21 00 - Allowances. For allowance cost adjustment, base Change Order Proposal on the difference between the actual purchase amount and the allowance, multiplied by the measurement for work-in-place. Submit substantiation of all changes in Work claimed in the Change Orders. The Owner reserves the right to establish the actual quantity of work-in-place by independent quantity survey, measure, or count.
 1. No change to the 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. A change in the Contractor's indirect expense will only be allowed when it is clearly demonstrated that either the nature or scope of the Work was changed from that which could be foreseen from the description of the allowance and other information in the Contract Documents.
- E. Construction Change Directive: Construction Change Directives, containing descriptions of changes in the Work and designating methods to be followed to determine changes in the Contract Sum and/or Contract Time may be issued by the Architect.
 1. Maintain detailed records of time and materials related to the Work required by the Construction Change Directive. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.
- F. Change Order Procedures: Upon the Owner's approval of a Change Order Proposal Request, the Architect will issue a Change Order for signatures of the Owner and Contractor, in triplicate.

1.05 SUBSTITUTIONS

- A. Substitutions are changes, modifications or deviations in those products, materials, equipment, and methods of construction required by the Contract Documents proposed by the Contractor after the receipt of Bids. Substitutions for the convenience of the Contractor or subcontractors, or materials suppliers will only be considered if submitted prior to the receipt of Bids, in strict conformance with the Instructions to Sub-bidders. The following shall not be considered substitutions:
 - 1. Changes, modifications, or deviations requested by Bidders during the bidding period and accepted prior to the receipt of Bids shall be considered as included in the Contract Documents and are not subject to the requirements of this Section.
 - 2. Revisions to Contract Documents requested by the Owner or Architect.
 - 3. Specified options of products or materials included in the Contract Documents.
 - 4. The Contractor's compliance with governing regulations and orders issued by governing authorities, subject to the Architect's prior written notice and approval.
- B. Substitution Requests: See Section 01 60 00 - Product Requirements, for substitution request procedures.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for requirements regarding submission of:
 - 1. Outline Construction Schedule.
 - 2. Comprehensive Construction Schedule.
 - 3. Schedule of Materials.
 - 4. Schedule of Submittals.
 - 5. Shop Drawings, Product Data and Samples.
 - 6. Mock-ups and Sample Field Installations.
 - 7. Requests for Substitution

1.07 ELECTRONIC MEDIA

- A. Electronic Media: See Section 01 00 30 - Electronic Media, for information regarding obtaining the Contract Documents electronically and their limited use for purposes of project coordination, Contractor's use in the preparation of submittals, and Contractor's use in the preparation of Record Drawings.

1.08 COST CONTROL

- A. Cost Estimating: The Contractor shall take charge of, and assume sole responsibility for, all construction cost estimating. He shall provide cost data of not less than industry standard degree of accuracy to the Owner and Architect on a timely basis, in order to allow adequate time for Project budgeting and design. At a minimum, budget updates shall be provided during each of the traditional phases of design (Schematic Design, Design Development, and 75% Construction Documents).
- B. Availability of Documentation: It is understood that the Contractor will prepare his initial cost estimates without the benefit of complete architectural and engineering documents. Therefore, it shall be the Contractor's responsibility to satisfy himself that he has conducted his own investigations, reasonably identified the full scope of the Work, made appropriate allowances and contingencies, and acquired an understanding of the Project adequate for the preparation of accurate and reliable estimates.

1.09 QUALITY CONTROL

- A. General: The Owner shall employ an independent testing agency for the purpose of testing and inspecting portions of the Work in progress. The Contractor and his various subcontractors shall be responsible for specific testing and inspections as identified in individual specification sections. See Section 01 40 00 - Quality Requirements and Section 01 21 00 - Allowances.

1.10 TEMPORARY FACILITIES

- A. See Section 01 50 00 - Temporary Facilities and Controls, for information regarding:
 - 1. Field offices and storage sheds.

2. Project signs.
3. Temporary stairs, hoists, and lifts.
4. Temporary enclosures and heat.
5. Sanitary facilities.
6. Temporary protective covering of finished work.
7. Temporary protection of existing facilities.
8. Temporary fire protection.
9. Clean-up and waste removal.

1.11 PROJECT MEETINGS

- A. The Contractor shall schedule the following project meetings including but not limited to:
 1. Pre-Construction Meeting.
 2. Pre-Installation Meetings.
 3. Coordination Meetings.
 4. Job Meetings.
 5. Project Close-out Meeting.
 6. Other meetings as necessary.
- B. Pre-Construction Meeting: The Contractor shall conduct an initial organization meeting at the Project site or other convenient location after the Notice to Proceed and prior to commencement of construction activities. The Owner, Architect, Owner's Representative, Contractor, his Superintendent, major subcontractors, and other concerned parties shall each be represented at the meeting by persons familiar with and authorized to conclude matters related to the Work. The Contractor shall record the minutes of this meeting. The minutes shall be distributed promptly to all participants.
 1. Agenda items shall include, but not be limited to:
 - a. Notice to Proceed
 - b. Designation of personnel representing the parties and their responsibilities.
 - c. Contract Documents: on-site documents, discrepancies or omissions, interpretations and clarifications.
 - d. Subcontractors
 - e. Schedule of Values
 - f. Insurance requirements.
 - g. Application for Payment: progress payments, Substantial Completion, off-site stored materials.
 - h. Project meetings.
 - i. Layout.
 - j. Scheduling: Construction schedule, working hours, overtime, holidays.
 - k. Permits and regulations
 - l. Testing and inspections.
 - m. Submittals: schedule, process, shop drawings, samples, record documents.
 - n. Substitutions.
 - o. Changes.
 - p. Job responsibilities: Superintendent, Owner's Representative.
 - q. Temporary facilities: parking, staging areas, site security, water, power, clean-up
 - r. Job safety, including but not limited to Owner Safety Policies.
 - s. Phasing and Sequencing.
- C. Pre-Installation Meetings: The Contractor shall conduct pre-installation meetings before each major construction activity that requires coordination is begun. Attendees may include the Contractor, Superintendent, Owner's Representative, Architect, Installers, Manufacturer's representatives, and fabricators. Refer to individual Specification Sections for required pre-installation meetings. Review progress of other construction activities and preparation for the particular activity under consideration.
- D. Coordination Meetings: The Contractor shall conduct coordination meetings at regularly scheduled times convenient to all parties. All major subcontractors shall be represented, and

other trades or subcontractors as required for coordination, planning and scheduling construction activities. The Contractor shall bring any significant issues to the next Job Meeting.

- E. Job Meetings: The Contractor shall conduct regular job meetings once every two weeks, or more frequently if required, during the construction period, at such time as is mutually acceptable to the Owner, Architect and Contractor. All major subcontractors shall be represented at each meeting as needed. Other trades or subcontractors may be called to particular job meetings as the progress of the Work requires. The Contractor shall record the minutes of each meeting. The minutes shall be distributed promptly to all participants.
1. Agenda items shall include, but not be limited to:
 - a. Review construction progress since the last meeting.
 - b. Review work progress in relation to the Construction Schedule.
 - c. Review "Old Business" and new items significant to the Work.
 - d. Review issues regarding construction activities and Owner's on-going occupancy.
 - e. Review work sequence, deliveries, hazards, quality standards, housekeeping, security, etc.
 - f. Review Change Orders, Proposal Requests, Requests for Information, Supplemental Instructions.
 - g. The Contractor will distribute updated Construction Schedule once per month.
- F. Project Close-out Meeting: See Section 01 78 00 - Project Close-out.

1.12 WARRANTIES

- A. See Section 01 78 10 - Warranties, for requirements regarding submission of a bound set of warranties and certificates as required by the Contract Documents.

1.13 PROJECT CLOSE-OUT

- A. See Section 01 78 00 - Project Close-out, for requirements regarding:
1. Substantial Completion procedures, including Project Close-out Meeting and Occupancy Permit.
 2. Architect's evaluation of the Work.
 3. Final Acceptance procedures.
 4. Project record documents submittal, including O&M manuals, warranties binder, record photographs, and record drawings.
 5. Spare parts and extra materials procedures.
 6. Operating and maintenance instructional sessions.
 7. Final cleaning.
 8. Contractor's Certificate of No Hazardous Materials.
 9. Testing agency final report.
 - a. Building air-tightness testing final report.
- B. Occupation by the Owner: The Owner shall have the right to take possession of and use any completed or partially completed portions of the Work, notwithstanding the fact that the time for completing the entire Work or such portions thereof may not have expired; but such possession and use shall not be an acceptance of the Work.

1.14 TIME FOR COMPLETION

- A. Time is of the essence of the Contract, and the Work to be performed under the Contract shall be Substantially Complete on all phases and in receipt of an Occupancy Permit on date indicated on 00 11 13 – Notice to Contractors.
- B. It is expressly understood and agreed, by and between the Contractor and the Owner, that the time for completion of the Work described herein is reasonable for the completion of same, taking into consideration the climatic and industrial conditions prevailing in this locality.

END OF SECTION

SECTION 01 00 30
ELECTRONIC MEDIA

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The provisions of this Section apply to each and every contract and contractor or other person or persons supplying labor, material, equipment and/or services entering into this Project and/or on the premises directly or indirectly.
- B. Following the receipt of a written request by the Contractor, signed Electronic Data Transfer and Non-Disclosure Agreement, and if applicable, payment in full from the Contractor, the Architect will make available an electronic data version of the Project, for the limited purposes described in this Agreement. It shall be the Contractor's responsibility to make electronic files available to subcontractors in accordance with the Electronic Data Transfer and Non-Disclosure Agreement.

ELECTRONIC DATA TRANSFER AND NON-DISCLOSURE AGREEMENT

The Agreement is entered into and agreed by, between and among Lavallee Brensinger Professional Association (LBA), and _____ (Recipient) and is made in reference to the (Specify either) SMCC – Health Science Center Renovations. It is understood and agreed that it may become desirable for LBA to make certain Instruments of Service in electronic machine-readable format, hereinafter referred to as "Electronic Data" available to other parties related to the Project. It is also understood that such information is proprietary to LBA and that LBA intends to limit its distribution and use. It is the intent of the Agreement to govern all circumstances under which Electronic Data is made available by LBA.

In consideration of the request of _____ (Recipient) to LBA to deliver to Recipient or otherwise enable the Recipient to access certain Electronic Data for use on the Project, the parties mutually agree as follows:

1. Electronic Data includes but is not limited to, computer-aided design files including native file formats (DWG), Building Information Models (BIM), files produced by word processing, spread sheet, scheduling, data base and other software programs. Computer-Aided-Design files shall be provided as Autocad.dwg files. Building Information Models shall be provided as Revit.rvt files.

2. The means by which the Electronic Data is transferred may include, but are not limited to, electronic mail, File Transfer Protocol sites and CD-Rom, transmitted between the parties in this Agreement. Recipient acknowledges that Electronic Data transferred in any manner or translated from the system and format used by LBA to an alternate system or format is subject to errors that may affect the accuracy and reliability of the data and that the data may be altered, whether inadvertently or otherwise. Accordingly, LBA makes no warranty, express or implied, as to the correctness, accuracy, and/or completeness of the information transferred. Although LBA may issue information throughout the development of the Project, LBA does not represent that the information provided includes all revisions to-date, nor shall LBA assume any responsibility for providing updated information as the Project proceeds.

3. LBA reserves the right to retain hard copy originals in addition to electronic copies of the Electronic Data transferred, which originals shall be referred to and shall govern in the event of any inconsistency with the transferred data. Should the recipient discover errors or conflicts in any transferred files, he shall promptly notify LBA.

4. As consideration to LBA for the transfer of the Electronic Data, Recipient agrees that the use of Electronic Data shall be entirely at his/her own risk, and that LBA shall not be liable for, and Recipient hereby waives all claims and agrees to indemnify and hold LBA harmless from all liabilities, claims, losses, damages or expenses (including attorneys' fees) arising out of, or connected with: (1) the transfer of Electronic Data by any means; or (2) the use, modification or misuse of the Electronic Data by parties other than LBA; or (3) the limited life expectancy and decline of accuracy or readability of the Electronic Data due to storage; or (4) translation and data errors; or (5) any use of the Electronic Data by any third parties receiving the data from other parties to this Agreement; or (6) the incompatibility of software or hardware used by LBA and the other parties to this Agreement.

5. The Electronic Data provided by LBA under the terms of this Agreement is the proprietary information of LBA, containing designs, details, model elements and other information developed by LBA. LBA is willing to supply such information only if the Recipient enters into this Non-Disclosure Agreement and agrees to strictly enforce its terms and conditions. All Electronic Data is to be treated as confidential and is not to be disclosed to or shared with any third parties, not expressly allowed herein, without LBA's express, written consent.

6. Recipient agrees to maintain and protect any and all proprietary information of LBA and to exercise great care in the preservation of its confidentiality. The Recipient will disclose the proprietary information only to its own employees, and then only to the extent required for the design and construction of this Project. The Recipient shall be responsible for any unauthorized use or disclosure of LBA's proprietary information by anyone to whom it may disclose such information.

7. The Recipient agrees that any and all Electronic Data shall remain the property of LBA. Neither the execution of this Agreement, nor the transfer of Electronic Data shall constitute a conveyance or transfer to the Recipient of any right, interest, or license in the proprietary materials. The Recipient shall not reproduce any proprietary information without the express written authorization of LBA.

8. Electronic Data are provided as a convenience to the Recipient for informational purposes only in connection with the Recipient's performance of its responsibilities and obligations relating to the Project. The Electronic Data do not replace or supplement the paper copies of the Drawings and Specifications which are and remain, the Contract Documents for the Project.

9. Electronic Data shall only be used for purposes allowable by this Agreement. It is understood and agreed that, without the separate express written permission of LBA to do so, the Electronic Data are not to be used for any purpose whatsoever, by anyone (any contractor or any of its subcontractors of any tier or any materials supplier or vendor) other than the Recipient. It shall be the responsibility of the Recipient to notify LBA of any and all third parties with whom the Recipient wishes to share LBA's Electronic Data, to identify the intended uses of the information, and to obtain LBA's prior written authorization to share LBA's information.

10. All transmittal of Electronic Data whether by CD-Rom, e-mail, Internet or any other methods shall require that the file name, size, date and time be recorded along with the date and time of transmission (if by electronic means) and the identity of the sender and recipient.

11. The Recipient further agrees to indemnify and save harmless LBA and its sub-consultant and each of their partners, officers, shareholders, directors and employees from any and all claims, judgments, suits, liabilities, damages, costs or expenses (including reasonable defense and attorneys' fees) arising as the result of either: 1) Recipient's failure to comply with any of the requirements of the Electronic Data Transfer Agreement; or 2) a defect, error or omission in the Electronic Data or the information contained therein, which defect error or omission was not contained in the Contact Documents as defined in paragraph 3 or where the use of such Contact Documents would have prevented the claim, judgment, suit, liability, damage, cost or expense.

12. This agreement shall be interpreted under the laws of the State of New Hampshire. The Recipient hereby agrees that the breach of this Agreement by the Recipient will cause LBA considerable harm, and LBA shall be entitled to recover damages, as well as all expenses and costs incurred by LBA arising out of or related to such breach, including, without limitation, reasonable attorney's fees and costs.

13. In general, the protocols for the distribution of Electronic Data shall be as follows:

- a. LBA may make certain Electronic Data available to _____ (Recipient - MUST be Owner, Construction Manager or General Contractor) free of charge, providing that:
 - 1) Such files can be issued in the format currently used by LBA, without modification.
 - 2) The Recipient delivers to LBA a fully executed copy of this Agreement and, among other requirements, agrees not to share LBA's Electronic Data with any third parties without LBA's prior written authorization.
- b. In the event the Recipient wishes to share LBA's Electronic Data with a third party:
 - 1) The Recipient shall first forward a complete list of all such third parties to LBA for LBA's prior written authorization. The list shall include all third-party names, addresses, telephone numbers, and email addresses.
 - 2) Each individual third party shall then deliver, through the Recipient, a fully executed copy of this Agreement.
- c. In the event that it is necessary for LBA to convert files from its currently used format to an alternative format, LBA shall be compensated for such conversion at the rate of \$75.00 per file, payable in advance.

The parties have executed this Agreement as of the dates stated below:

RECIPIENT

Company: _____

By: _____

Title: _____

Date: _____

LBA

Title: _____

Date: _____

END OF SECTION

SECTION 01 23 00
ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Description of alternates.
- B. The Contractor shall provide all labor, materials, equipment, and services, etc., necessary for the proper and complete execution of accepted Alternates. Amount of Alternate prices to be added to or deducted from the Base Bid shall be stated on the Proposal Form and shall include cost of any and all modifications made necessary by Owner's acceptance of Alternates.
- C. Related Work Described Elsewhere:
 - 1. Materials and methods to be used in the Base Bid, and in the Alternates, are generally described in the Contract Documents.
 - 2. Method for stating the proposed Contract Sum is described in the Proposal Form.
- D. NOTE: Alternates will be carefully considered in the Owner's selection of a Contractor.

1.02 RELATED REQUIREMENTS

- A. Section 00 21 13 - Instructions to Sub-bidders: Instructions for preparation of pricing for alternatives.

1.03 ACCEPTANCE OF ALTERNATES

- A. If the Owner elects to proceed on the basis of one or more of the described Alternates, make all modifications to the Work required in order to furnish and install the selected Alternate or Alternates to the approval of the Architect and at no additional cost to the Owner, other than as proposed on the Proposal Form.
- B. After award of the Contract, or as soon thereafter as the Owner has made a decision on which, if any, Alternates will be selected, thoroughly and clearly advise all necessary personnel and suppliers as to the nature and extent of Alternates selected by the Owner. Use all means necessary to alert those personnel and suppliers involved as to all changes in the Work caused by the Owner's selection or rejection of Alternates.
- C. It shall be the responsibility of the Contractor to properly coordinate work related to Alternates with all other Work of this Contract in order to ensure that a complete and proper job is provided. Include as part of each Alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not mentioned as part of the Alternate.
- D. Submit a Schedule of Values including adjustments to all Sections affected by accepted Alternates.
- E. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted alternates will be identified in the Owner-Contractor Agreement.
- F. Coordinate related work and modify surrounding work to integrate the Work of each alternate.

1.04 SCHEDULE OF ALTERNATES

- A. Alternate No 1: Basement Slab Remediation.
 - 1. Base Bid Description: Provide high moisture glues as specified in Division 09 for floor finishes.
 - 2. Alternate Description: Provide Concrete Slab Moisture Barrier System, in the event of concrete slab testing resulting in unacceptable substate conditions as required by floor finishes specified in Division 09. See Section 09 05 61 -Common Work Result for Flooring Preparation for required slab testing and concrete slab moisture barrier system. Provide this system for all new flooring on the Basement level.
- B. Alternate No 2: RTU-1 Replacement. Refer to mechanical and electrical drawings.
 - 1. Base Bid Description: Leave existing RTU-1 in place and fully operational.

2. Alternate Description: Remove existing RTU-1 that serves the first floor and replaced in kind as outlined within mechanical and electrical documents.
- C. Alternate No 3: ADA Door Hardware Replacement.
 1. Base Bid Description: Base bid scope assumes existing exit device trim (round knobs) can be replaced with lever trims. Provide scope as indicated on Door Schedule and in Sections 08 06 71 – Door Hardware Schedule and 08 71 00 – Door Hardware.
 2. Alternate Description: Fully replace exit devices with devices of the same function with lever trim. Summary as follows:
 - a. Replace exit devices at the following doors with Von Duprin 55 Series Exit Devices with 371L-BE passage trim: S010, S020, S011A, S021A, S012, S022.

END OF SECTION

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preconstruction meeting.
- B. Site mobilization meeting.
- C. Job meetings.
- D. Construction reports.
- E. Materials Schedule.
- F. Submittal Schedule.
- G. Progress photographs.
- H. Coordination Drawings.
- I. Shop Drawings.
- J. Approval Drawings.
- K. Product Data, Certifications, Delegated-Design Submittals
- L. Submittals for review, information, and project closeout.
- M. Submittal procedures.
- N. Architect's Review

1.02 RELATED REQUIREMENTS

- A. Section 01 00 00 - General Requirements.
- B. Section 01 78 10 - Warranties.
- C. Section 01 78 00 - Project Close-out: Project record documents.

1.03 PROJECT COORDINATION

- A. Project Coordinator: Contractor.
- B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for delivery access, traffic, and parking facilities.
- C. During construction, coordinate use of site and facilities through the Project Coordinator.
- D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities.
- F. Coordinate field engineering and layout work under instructions of the Project Coordinator.
- G. Make the following types of submittals to Architect through the Project Coordinator:
 - 1. Requests for interpretation.
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Test and inspection reports.
 - 5. Design data.
 - 6. Manufacturer's instructions and field reports.
 - 7. Applications for payment and change order requests.
 - 8. Progress schedules.
 - 9. Coordination drawings.
 - 10. Correction Punch List and Final Correction Punch List for Substantial Completion.

11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

- A. Architect will schedule a meeting after Notice of Award.
- B. Attendance Required:
 1. Owner.
 2. Architect.
 3. Contractor.
- C. Agenda:
 1. Introductions of attendees and their Project duties.
 2. Submission of executed bonds and insurance certificates.
 3. Distribution of Contract Documents.
 4. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
 5. Designation of personnel representing the parties to Contract, General Contract, Owner and Architect.
 6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 7. Scheduling.
- D. Contractor shall record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.02 SITE MOBILIZATION MEETING

- A. The Contractor shall schedule a meeting at the Project site prior to his occupancy.
- B. Attendance Required:
 1. Contractor.
 2. Owner.
 3. Architect.
 4. Contractor's Superintendent.
 5. Major Subcontractors.
- C. Agenda:
 1. Use of premises by Owner and Contractor.
 2. Owner's requirements and occupancy prior to completion.
 3. Construction facilities and controls provided by Owner.
 4. Temporary utilities provided by Owner.
 5. Survey and building layout.
 6. Security and housekeeping procedures.
 7. Schedules.
 8. Application for payment procedures.
 9. Procedures for testing.
 10. Procedures for maintaining record documents.
 11. Requirements for start-up of equipment.
 12. Inspection and acceptance of equipment put into service during construction period.
 13. Safety.
- D. Contractor shall record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.03 JOB MEETINGS

- A. Schedule and administer meetings throughout progress of the Work at maximum bi-monthly intervals.
- B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, Architect, as appropriate to agenda topics for each meeting.
- D. Agenda:
 - 1. Review minutes of previous meetings.
 - 2. Review of Work progress.
 - 3. Field observations, problems, and decisions.
 - 4. Identification of problems that impede, or will impede, planned progress.
 - 5. Review of submittals schedule and status of submittals.
 - 6. Maintenance of progress schedule.
 - 7. Corrective measures to regain projected schedules.
 - 8. Planned progress during succeeding work period.
 - 9. Maintenance of quality and work standards.
 - 10. Review of testing and inspection reports.
 - 11. Effect of proposed changes on progress schedule and coordination.
 - 12. Other business relating to Work.
- E. Contractor shall record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.04 CONSTRUCTION REPORTS

- A. The Contractor's superintendent shall maintain an on-site daily construction log, recording the following information concerning events at the site and allow access to the Owner and Architect for review.
 - 1. List of subcontractors at the site.
 - 2. Approximate count of personnel at the site.
 - 3. Visitors at the site.
 - 4. High and low temperatures, general weather conditions.
 - 5. Accidents and unusual events.
 - 6. Meetings held at the site.
 - 7. Communications received or conveyed by the superintendent.
 - 8. Stoppages, delays, shortage, losses.
 - 9. Meter readings and similar recordings.
 - 10. Emergency procedures.
 - 11. Orders and requests of governing authorities.
 - 12. Testing agency observations and tests.
 - 13. Change orders received and implemented.
 - 14. Services connected, disconnected.
 - 15. Significant deliveries.
 - 16. Equipment or system tests and start-ups.
 - 17. Partial completions, occupancies.
 - 18. Substantial Completions authorized.

3.05 CONSTRUCTION PROGRESS SCHEDULE

- A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for the remainder of Work.
- B. Schedule a schedule review meeting for a joint review by the Owner, Architect and Construction Manager, and any major trades requested by the Construction Manager to be present.

- C. Within 10 days after joint review, submit complete schedule.
- D. Submit updated schedule with each Application for Payment.

3.06 CONTRACTOR'S SCHEDULE OF MATERIALS

- A. Within twenty-one (21) days after date established for the Commencement of the Work, prepare and submit to the Architect a projected schedule for materials delivery, clearly identifying all products with long lead times or which are likely to cause delay due to unavailability, extended delivery dates or any other reason. Once approved, long lead times shall be pre-ordered in a timely manner as not to delay the progress of the Work. The Contractor shall assume full responsibility for delays attributed to unavailability, insufficient time for delivery and/or installation of materials or performance of the Work, unless he has conformed with these instructions.

3.07 CONTRACTOR'S SUBMITTAL SCHEDULE

- A. Within ten (10) days after development and acceptance of the Contractor's Construction Schedule, prepare and submit to the Architect a complete schedule of submittals. Coordinate schedule with subcontractors and provide adequate time for review, processing and the possibility of non-acceptance and resubmission. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of ordering materials or performance of the Work to permit processing. Update schedule as necessary.

3.08 PROGRESS PHOTOGRAPHS

- A. Submit a minimum of 20 digital photographs with each application for payment, taken not more than 7 days prior to submission of Application For Payment.
 - 1. Provide an electronic file.
 - 2. Identify project name, date, description of view and key plan of location if needed.
- B. Maintain one set of all photographs at Project site for reference; same copies as submitted, identified as such.
- C. Select locations to provide diversified overall views of the Work, from positions that are expected to remain accessible throughout the progress of the Work. When so directed by the Architect, change locations to new locations inside or outside the building.
- D. Provide auxiliary lighting as required to produce clear, well lit photographs without obscuring shadows. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion
- E. Photography Type: Digital; electronic files.
- F. Provide photographs of site and construction throughout progress of Work.
- G. In addition to periodic, recurring views, take photographs of each of the following events:
 - 1. Excavations in progress.
 - 2. Foundations in progress and upon completion.
 - 3. Structural framing in progress and upon completion.
 - 4. Enclosure of building, upon completion.
- H. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
 - 1. Delivery Medium: On photo CD or by e-mail.
 - 2. File Naming: Include project identification, date and time of view, and view identification.
 - 3. Photo CD(s): Provide 1 copy including all photos cumulative to date and PDF file(s), with files organized in separate folders by submittal date.

3.09 SHOP DRAWINGS

- A. Shop Drawings: Shop drawings include fabrication and installation drawings, coordination drawings, setting diagrams, schedules, patterns, templates, and similar drawings specially prepared for the Work by the Contractor, subcontractors, manufacturers, fabricators, suppliers or distributors to illustrate some portion of the Work.

1. Shop drawings shall show the design, dimensions, connections, and other details necessary to ensure the accurate interpretation of the Contract Documents and shall show adjoining Work in such detail as required to provide for proper connection to same. Where adjoining Work requires shop drawings, they shall be submitted concurrently for a coordinated review.
2. Submit information specifically prepared for this Project, drawn to accurate scale. Do not reproduce Construction Documents or copy standard information as the basis for shop drawings. Standard information prepared without specific reference to the Project is not considered a shop drawing. Clearly and specifically indicate deviations from the Contract Documents.
3. In addition to the above, include the following information:
 - a. Dimensions and notation of dimensions established by field measurements.
 - b. Identification of products and materials included.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements and specific procedures.
 - e. Utility connections for equipment.
 - f. Identification of any change, variance or non-conformance with requirements of Contract Documents. Indicate with a "cloud" and provide detailed notation including reason for each change. Include completed "Contractor's Substitution Request" (See Section 01 60 00).
 - g. Indication by the Contractor that he has reviewed, coordinated (checked for dimension, quantity, relationship with work of all trades involved and is in accordance with the Contract requirements), and approved the Shop Drawing for submittal to the Architect.
4. Electronic Media: See Section 01 00 30 - Electronic Media, for information regarding obtaining electronic documents and their limited use for purposes of project coordination and the Contractor's use in the preparation of submittals.
 - a. Unless express written permission of the Architect is granted, electronic documents provided by the Architect and his consultants, shall not be used by the Contractor, or any of his subcontractors of any tier or any materials supplier or vendor as a shop drawing or any other type of submittal or as the basis for preparing such shop drawing or submittal, with the sole exception to this prohibition being that electronic documents may be used as backgrounds upon which to prepare shop drawings or other submittals.

3.10 COORDINATION DRAWINGS

- A. Coordination Drawings are a special type of shop drawing prepared by various trades to show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended.
 1. The Contractor shall arrange coordination meetings and require attendance of each (major) subcontractor in order to establish priorities for systems installation, to establish systems installation sequences, to determine and resolve potential conflicts, and to ensure that each trade has coordinated its work with the others and will honor commitments to other disciplines.
 2. Each subcontractor's representative shall sign the final coordination drawings, prior to submission for Architect's review, certifying they have coordinated each building system, resolved all potential conflicts between each trade's work, and have satisfied the intent of each disciplines design.
 3. Where potential conflicts cannot be resolved without input from, or review by, the Architect, the Contractor shall request said input/review, in writing, and provide all sketches, details, part plans, etc. necessary to convey fully the essence of the situation and/or potential conflict. The Contractor and all appropriate subcontractors shall make themselves available to meet with the Architect as required to resolve the issue(s) in question.

4. Coordination Drawings shall be required for all building structure, ductwork, and piping systems.

3.11 APPROVAL DRAWINGS

- A. Whenever the Contractor or subcontractor is required to submit Shop Drawings and/or Product Data to the Authority Having Jurisdiction over the Project for review and approval of a particular component or system, prior to starting on-site work, the Contractor shall submit to the Architect two (2) copies of the approved documents including the authority stamp and approving signature. Submit as "For Information Only".

3.12 RECORD DRAWINGS

- A. Record Drawings: See Section 01 78 00 - Project Close-out.

3.13 PRODUCT DATA

- A. Compile Product Data into a single submittal for each element of construction or complete system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, materials test reports, color charts, roughing-in diagrams, templates, and wiring diagrams. Mark each copy to show applicable choices and options.
 1. Identify any change, variance, or non-conformance with requirements of Contract Documents with a "cloud" and provide detailed notation including reason for each change. Provide a completed "Contractor's Substitution Request" (see Section 01 60 00).

3.14 CERTIFICATIONS

- A. Certifications from manufacturers and/or installers required in individual Specification Sections shall be submitted with Product Data.
 1. In accordance with Supplementary General Conditions, Article 3, prior to Substantial Completion, the Contractor shall submit a written certificate that no asbestos and/or other hazardous substances have been incorporated into the Work of this Project.
 2. Contractor's Asbestos/Hazardous Material Certification with the following language:
 - a. I, _____ the undersigned representing (company), do hereby certify that the products furnished and/or fabricated and/or installed by my firm under contract with (G.C. or C.M.) at the (Project) located in (project location) do not contain asbestos and /or other hazardous materials.
 - b. Provide signature, title and date.
 - c. The form of certificate shall be submitted to the Architect for review prior to use.

3.15 DELEGATED-DESIGN SUBMITTALS

- A. Where professional engineering services or certifications by a professional engineer are specifically required to be provided by the Contractor, provide products and systems complying with specific performance and design criteria indicated.
 1. If criteria indicated are not sufficient to perform services or certifications required, submit a written request for additional information to the Architect.
 2. In addition to Shop Drawings, Product Data, and other required submittals, submit a certification, signed and sealed by the responsible professional engineer, licensed in the State of the Project, for each product and system specifically assigned to the Contractor to be engineered or certified by a professional engineer, indicating that the products and systems are in compliance with performance and design criteria indicated. Include a list of codes, loads, and other factors used in performing these services.

3.16 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit for review:
 1. Product data.
 2. Shop drawings.
 3. Samples for selection.
 4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

- C. Samples will be reviewed only for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below.

3.17 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit for information:
 - 1. Design data.
 - 2. Certificates.
 - 3. Test reports.
 - 4. Inspection reports.
 - 5. Manufacturer's instructions.
 - 6. Manufacturer's field reports.
 - 7. Other types indicated.
- B. Submit for Architect's knowledge as contract administrator. No action will be taken.

3.18 SUBMITTALS FOR PROJECT CLOSEOUT

- A. When the following are specified in individual Sections, submit them at project closeout:
 - 1. Project record documents.
 - 2. Operation and maintenance data.
 - 3. Warranties.
 - 4. Bonds.
 - 5. Other types as indicated.
- B. Final Property Survey.
- C. Submit for Owner's benefit during and after project completion.

3.19 NUMBER OF COPIES OF SUBMITTALS

- A. Documents for Review: Submittals to the Architect shall be electronic files in PDF format, unlocked, markable and reproducible; an electronically-marked up file will be returned. Create PDFs at native size and right-side up. Illegible files will be returned. In addition to electronic files, a hard copy shall be provided if requested by the Architect.
- B. Samples: Confirm with the Architect the number of samples required for each submittal; one of which will be retained by Architect.
 - 1. After review, produce duplicates.
 - 2. Retained samples will not be returned to Contractor unless specifically so stated.

3.20 SUBMITTAL PROCEDURES

- A. Transmit each submittal with an approved form.
- B. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.
- C. Submittal form shall include identification information: Project name, Contractor, Subcontractor or supplier; product name, pertinent drawing and detail number, and specification section number, submittal category, date, and total number of pages in the submittal.
- D. Contractor's Action and Certification: The Contractor shall review each submittal, check for compliance with the Contract Documents, note corrections, note field dimension, and complete a review stamp with the following information:
 - 1. Contractor stamp, signed or initialed certifying that the submittal conforms to requirements of the Contract Documents in accordance with AIA A201, Paragraph 3.12.; or, Submittal deviates from requirements of the Contract Documents, with deviations clearly noted and marked with Contractor's initials; or, Contractor's substitution requested.
- E. Deliver submittals to Architect at business address. Submittals may only be sent directly to the Architect's consultants by special arrangement with the Architect. Subcontractors shall not directly send submittals to the Architect.
- F. Submittals of poor legibility may be returned without action.

- G. Submittals not including a completed Contractor's Certification will be returned without action.
- H. Submittals certified as in conformance by the Contractor and found to deviate from requirements of the Contract Documents will be returned without action.
- I. The Contractor may require sub-contractors to submit similar certification, however this shall not in any way relieve the Contractor of responsibility for review and certification of all submittals.
- J. All notations made on submittals by the Contractor, sub-contractors, suppliers, or fabricators shall be made in bold line type and initialed by person making the notations. Clearly indicate specified items with a "cloud" or arrows. Cross out all extraneous information not intended as part of the submission. Do NOT use highlighter or colored markings, only arrows, circles, text and the like that can be copied in black and white shall be allowed.
- K. Provide a detailed notation of all deviations from the Contract Document requirements including minor variations and limitations, and the reason for each deviation. Include a Contractor's Substitution Request.
- L. Contractor's Substitution Request: All requests for substitutions shall be submitted on the form included at the end of this Section. In addition, the Contractor shall submit a side-by-side comparison summary showing each listed specification, testing requirement, etc. of the specified product and the proposed substitution product for review by the Architect.
- M. Schedule submittals to expedite the Project, and coordinate submission of related items.
- N. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
- O. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.
- P. Provide space for Contractor and Architect review stamps.
- Q. When revised for resubmission, identify all changes made since previous submission.
- R. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
- S. Submittals not requested will not be recognized or processed.
- T. Do not order materials or proceed with the Work requiring submission and review of Product Data, Shop Drawings, Samples or similar submittals prior to receiving acceptance of the submittal from the Architect.
- U. The Contractor shall not use or take submittals on-site without the Architect's or the Architect's consultant's Submittal Stamp indicating acceptance. Submittals without this stamp or with a stamp indicating non-acceptance shall not be used in connection with construction.

3.21 ARCHITECT'S REVIEW

- A. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Architect will review each submittal and mark to indicate action taken.
 - 1. In general, the Architect will strive to complete his review of submittals and return them to the Contractor in approximately two (2) weeks. Additional time may be required if large volumes of submittals are simultaneously delivered to the Architect for review. Where concurrent review of submittals by Architect's consultants, Owner, or other parties is required, allow three (3) weeks for initial review of each submittal.
 - 2. The Architect will not review submittals of colors and finishes until submittals for all such related materials are complete and delivered for collective review. This same requirement may be extended to other components and systems as deemed appropriate by the Architect.
 - 3. The Architect's review shall, among other limitations, not include the calculation, coordination, or verification of dimensions or quantities, which shall be the sole responsibility of the Contractor.

4. Action Stamp: The Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows to indicate the action taken. The exact verbiage of these marks shall be used by the contractor within their Internet-based submittal service:
 - a. Final Unrestricted Release: Where submittals are marked "**No Exceptions Taken**", that part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents.
 - b. Final-but-Restricted Release: Where submittals are marked "**Make Corrections Noted**", that part of the Work covered by the submittal may proceed provided it complies with markings / comments and requirements of the Contract Documents.
 - c. Returned for Resubmittal: Where submittals are marked "**Revise and Resubmit**", do not proceed with that part of the Work covered by the submittal including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat as necessary to obtain a different action mark.
 - d. Rejected: When the submittal is marked "**Rejected**", do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Do not resubmit that product.
 - e. Record Submittals. Where a submittal is for record purposes, the submittal will be returned marked "**Received for Record**".
 - f. Where a submittal cannot be reviewed due to lack of Contractor review or illegibility, for example, the submittal will be returned marked "**Rejected**".

END OF SECTION

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. References and standards.
- B. Quality assurance submittals.
- C. Samples, Mock-ups and Sample Field Installations.
- D. Control of installation.
- E. Tolerances.
- F. Testing and inspection services.
- G. Manufacturers' field services.

1.02 RELATED REQUIREMENTS

- A. Document 00 72 00 - General Conditions: Inspections and approvals required by public authorities.
- B. Section 01 00 00 - General Requirements.
- C. Section 01 30 00 - Administrative Requirements: Submittal procedures.
- D. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

1.03 REFERENCE STANDARDS

- A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2014).
- B. ASTM C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2014.
- C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2013.
- D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2012a.
- E. ASTM E329 - Standard Specification for Agencies Engaged Construction Inspection and/or Testing; 2014a.
- F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2013.
- G. IAS AC89 – Accreditation Criteria for Testing Laboratories; 2010.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Contractor's Testing Agency Qualifications:
 - 1. Prior to start of Work, submit agency name, address, and telephone number, and names of full-time registered Engineer and responsible officer.
- C. Contractor's Test Reports: After each test/inspection, promptly submit one copy of reports to Architect, Engineer, Building Official and to Owner. Information required on Test Reports shall be as identified herein for the Owner's Testing Agency.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.

- f. Location in the Project.
 - g. Type of test/inspection.
 - h. Date of test/inspection.
 - i. Results of test/inspection.
 - j. Conformance with Contract Documents.
 - k. When requested by Architect, provide interpretation of results.
- C. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
 - 1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 - 2. Certificates may be recent or previous test results on material or product but must be acceptable to Architect.
- D. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- E. Manufacturer's Field Reports: Submit reports within 10 days of observation to Architect and Owner for their information.
- F. Erection Drawings: Submit drawings to the Architect and Owner for their information.
 - 1. Submit for information for the sole and limited purpose of generally assessing conformance with the design intent expressed in the Contract Documents.
 - 2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner.

1.05 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

1.06 TESTING AND INSPECTION AGENCIES

- A. Quality control services include inspections, tests, and related actions including reports performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Architect.
- B. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.
- C. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.
- D. Inspections, tests and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.
- E. Requirements for the Contractor to provide quality control services as directed by the Architect, Owner, or authorities having jurisdiction are not limited by the provisions of this Section.

- F. The Owner will employ and pay for services of an independent testing and inspection agency(s) to perform Special Inspections and certain other specified testing and inspection. See paragraph TESTING AND INSPECTIONS.
- G. Contractor shall employ and pay for services of an independent testing agency to perform other specified testing and inspection. See paragraph TESTING AND INSPECTIONS.
- H. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- I. Testing and Inspection Agencies Quality Assurance:
 - 1. Testing agency: Comply with requirements of ASTM E 329, ASTM E 543, ASTM C 1021, ASTM C 1077, ASTM C 1093, and ASTM D 3740.
 - 2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.
 - 3. Laboratory: Authorized to operate in the State in which the Project is located.
 - 4. Laboratory Staff: Maintain a full-time registered Engineer on staff to review services.
 - 5. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step-in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have Work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on Shop Drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 SAMPLES, MOCK-UPS AND SAMPLE FIELD INSTALLATIONS

- A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
- B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
- C. Room Mock-ups: Construct room mock-ups as indicated on Drawings. Coordinate installation of materials, products, and assemblies as required in Specification Sections; finish according to requirements. Provide required lighting and any supplemental lighting where required to enable Architect to evaluate quality of the mock-up.
- D. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.
- E. Tests shall be performed under provisions identified in this Section and identified in the respective product Specification Sections.

- F. Assemble and erect specified items at full scale, with specified attachment and anchorage devices, flashings, seals, and finishes.
- G. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
 - 1. Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.
- H. The purpose of mock-ups and sample field installations shall be to clearly establish standards of quality for the Work prior to proceeding with the Work itself. They shall be constructed in sizes, locations and quantities as directed by the Architect.
- I. To the extent possible, all samples, mock-ups and sample field installations accepted by Architect shall be preserved until the Work itself has been completed and accepted by the Architect. The alteration, destruction or removal of mock-ups and sample installations shall not commence without the Architect's prior authorization.
- J. The Contractor and/or his subcontractors shall construct or prepare all samples, mock-ups and sample field installations as required in individual Specification Sections or as directed by the Architect.
- K. Sample field installations are full sized, fully fabricated, cured, and finished built in-place assemblies that maybe permanent if acceptable to the Architect.
- L. Samples shall be clearly marked with the manufacturer's name, generic description of the sample and compliance with required standards. Where samples are for selection of color, pattern, texture, or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.
- M. All costs related to providing, maintaining and removing required samples, mock-ups and sample field installations shall be paid by the Contractor.

3.03 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

- A. See individual Specification Sections for testing and inspections required.
- B. Testing Agency Duties and Responsibilities:
 - 1. Test samples of mixes submitted by Contractor.
 - 2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 3. Perform specified sampling and testing of products in accordance with specified standards.
 - 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 5. Promptly notify (within 24 hours) Owner, Architect and Contractor of observed irregularities or non-conformance of Work or products during performance of its services.
 - 6. Perform additional tests and inspections required by Architect.
 - 7. Verify samples submitted by Contractor comply with the referenced standards and the approved contract documents.
 - 8. Attend preconstruction meetings and progress meetings, as requested.
 - 9. Submit written reports of all tests, inspections or other services to the AHJ, Architect, Structural Engineer of Record, Owner and Contractor. Reports indicating compliant inspections shall be submitted within three (3) days. Reports shall include:
 - a. Date of issue.
 - b. Project name and number.
 - c. Name, address, and telephone number of testing agency.

- d. Dates and locations of samples and tests or inspections.
 - e. Names of individuals making tests or inspections.
 - f. Designation of the Work and test method.
 - g. Identification of product and Specification Section.
 - h. Complete inspection or test data.
 - i. Test results and interpretations of test results.
 - j. Ambient conditions at time of sample taking, testing, or inspection.
 - k. Comments or professional opinion regarding whether inspected or tested Work complies with the Contract Documents.
 - l. Recommendations for re-testing.
 - m. Name and signature of laboratory inspector.
8. The Testing Agency shall maintain a complete deficiency list of all items not corrected and shall re-test and/or re-inspect as required after each deficiency has been corrected. All such re-testing and re-inspection shall be at the Contractor's expense. The Testing Agency shall submit a final signed report, stating whether or not all corrections have been made and the Work tested and inspected conforms to the Contract Documents.
9. Limits on Testing/Inspection Agency Authority:
- a. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - b. Agency may not approve or accept any portion of the Work.
 - c. Agency may not assume any duties of Contractor.
 - d. Agency has no authority to stop the Work.
- C. Owner Duties and Responsibilities:
- 1. The Owner will provide Special Inspections, observations, inspections, tests and similar quality control services specified to be performed by independent agencies, except where they are specifically indicated as the Contractor's responsibility or are provided by another identified entity. The costs for Owner provided testing and inspection services shall be paid for by the Owner.
 - 2. The Owner will employ directly an independent agency, testing laboratory, or other qualified firm to perform Inspections and other testing that are the Owner's responsibility. See individual Specification Sections for the scope of such inspections and tests.
 - 3. Such other specified testing as indicated in individual Specification Sections, including but not limited to:
 - a. Division 9: Concrete slab moisture, humidity and Ph testing.
- D. Contractor's Testing and Inspections:
- 1. The Contractor shall provide inspections, tests and similar quality control services, specified in individual Specification Sections, except where they are specifically indicated to be the Owner's responsibility, or are provided by another identified entity. Costs for these services shall be included in the Contract Sum.
 - 2. The Contractor shall employ and pay an independent testing agency to perform quality control services, including but not limited to inspections, sampling and tests required for determining the suitability of materials prior to delivery to the site and other services as specified in the Specification Sections. Such inspections and tests shall include, but may not be limited to the following:
 - a. Analysis of loam.
 - b. Off-site borrow.
 - c. Concrete mix designs and pre-construction tests.
 - d. Sealant testing.
 - e. Electrical systems.
 - f. HVAC systems.
 - g. Piping systems.
 - h. Fire suppression system testing.
 - i. Indoor air quality.
 - j. Fireproofing.

- k. Wall substrate moisture testing for paints and coatings.
 - l. Roofing.
 - m. Where the Owner has engaged a testing agency or other entity for testing and inspection of a part of the Work and the Contractor is also required to engage an entity for the same or related element, the Contractor shall not employ the entity engaged by the Owner, unless otherwise agreed in writing with the Owner.
 - 3. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 - 4. Cooperate with laboratory personnel and provide access to the Work and to manufacturers' facilities.
 - 5. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 - 6. Scheduling: Notify Testing Agency, Special Inspector, Owner's Representative and, Architect sufficiently in advance of operations to allow for the proper assignment of personnel and scheduling of testing and inspections.
 - 7. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
 - 8. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing:
- 1. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect.
 - 2. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.
 - 3. The Contractor is responsible for re-testing where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with the Contract Document requirements, regardless of whether or not the original test was the Contractor's responsibility. Cost of re-testing construction revised or replaced by the Contractor is the Contractor's responsibility.
- F. Indoor Air Quality Testing:
- 1. The Contractor shall engage the services of a Certified Industrial Hygienist, using an AIHA accredited laboratory to comply with RSA 10-B, Chapter 1800 Occupational Health Rules (New Hampshire Air Quality Act).
- G. Electrical and Mechanical Systems Final Testing:
- 1. The Contractor shall engage the services of registered professional mechanical and electrical engineers who shall witness testing of all HVAC, lighting, and power distribution systems in accordance with the requirements of the applicable Energy Code. The registered professional engineer(s) shall prepare a final performance acceptance report in accordance with the code requirements and in a form acceptable to the local code official. The Contractor, his designated subcontractor(s) or authorized manufacturer's representatives shall perform the actual testing. All costs associated with the testing, witnessing of the testing and preparation of reports shall be paid by the Contractor.
- H. Building Air-tightness Testing:
- 1. The Owner may conduct Building Air-Tightness testing. See Section 07 25 00 - Weather Barriers.

3.05 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of

surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.

- B. Report in writing, observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not conforming to specified requirements.
- B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01 45 33
CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Code-required special inspections.
- B. Submittals.

1.02 RELATED REQUIREMENTS

- A. Section 01 40 00 - Quality Requirements: General requirements for testing and inspections and project testing and inspections other than Special Inspections.
- B. Statement of Special Inspections; following this Section.

1.03 DEFINITIONS

- A. Code or Building Code: 2021 Edition of the International Building Code, Chapter 17 - Structural Tests and Inspections.
- B. Authority Having Jurisdiction (AHJ): Agency or individuals officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.
- C. Special Inspections:
 - 1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the building code and AHJ that also require special expertise to ensure compliance with the approved contract documents and the referenced standards.
 - 2. Special inspections are separate from and independent of tests and inspections conducted by Owner or Contractor for the purposes of quality assurance and contract administration.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Special Inspectors Qualifications: Prior to the start of work, proposed Special Inspectors shall submit their qualifications to the AHJ for review and acceptance.
- C. Testing & Inspections Agency Qualifications: Prior to the start of work, the Testing & Inspections Agency shall submit the following to the AHJ, Architect, Structural Engineer of Record, Owner and Contractor:
 - 1. Agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
 - 2. Copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Documentation that Testing Agency is accredited by IAS according to IAS AC89.
- D. Special Inspection Reports: After each special inspection, all Special Inspectors and Testing Agencies shall promptly submit copies of their report to Architect, Structural Engineer of Record, Owner, Contractor, and AHJ at intervals identified on the Statement of Special Inspections.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of Special Inspector.
 - d. Date and time of special inspection.
 - e. ICC, AWS and ACI certification #s.
 - f. Identification of product and Specifications Section.
 - g. Location in the Project.

- h. Type of test or special inspection.
 - i. Date of test or special inspection.
 - j. Results of test or special inspection. Failing inspections and tests, as well as retests shall be clearly identified.
 - k. Compliance with Contract Documents.
 - 2. Final Special Inspection Report: Each Special Inspector shall submit a Final Report upon the conclusion of each special inspection regime. Document special inspections and correction of failed testing and inspections, corrective action and successful re-tests in a final report to be submitted to the AHJ, Architect, Structural Engineer of Record, Contractor and Owner.
 - 3. As required by the Building Code, the Architect as Registered Design Professional in Responsible Charge shall assemble all Final Reports submitted by the Special Inspectors, determine that all required test and inspection reports have been submitted, and submit a Project Final Report Summary to the AHJ, Owner and Contractor.
- E. Fabricator Special Inspection Reports: After each special inspection of fabricated items at the Fabricator's facility, Special Inspector shall promptly submit copies of report to Architect, Structural Engineer of Record, Contractor, Owner and AHJ.
- 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of Special Inspector.
 - d. Date and time of special inspection.
 - e. Identification of fabricated item and specification section.
 - f. Location in the Project.
 - g. Results of special inspection.
 - h. Verification of fabrication and quality control procedures.
 - i. Compliance with Contract Documents.
 - j. Compliance with referenced standard(s).
- F. Test Reports: After each test or inspection, promptly submit copies of report to Architect, Structural Engineer of Record, Contractor, Owner and AHJ.
- 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test or inspection.
 - h. Date of test or inspection.
 - i. Results of test or inspection.
 - j. Compliance with Contract Documents.

1.05 TESTING AND INSPECTION AGENCIES

- A. The Owner shall employ services of an independent testing and inspection agency and/or agencies to perform inspections and tests associated with Special Inspections required by the building code.
 - 1. The Owner will employ services of an independent testing agency to perform certain other testing and inspections that are not Special Inspections as identified in Section 01 40 00.
 - 2. The Contractor shall employ services of an independent testing agency(s) to perform certain other testing and inspections that are not Special Inspections as identified in Section 01 40 00.
- B. Employment of agency(s) in no way relieves the Contractor of the obligation to perform the Work in accordance with requirements of the Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SCHEDULE OF SPECIAL INSPECTIONS, GENERAL

- A. Frequency of Special Inspections: Special Inspections are indicated as continuous, periodic, or aperiodic.
 - 1. Continuous Special Inspection: Approved individual of the Special Inspection agency shall be present in the area where the work is being performed and observe the work at all times the work is in progress.
 - 2. Periodic Special Inspection: Approved individual of the Special Inspection agency shall be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.
 - 3. Aperiodic Special Inspection: Approved individual of the Special Inspection agency shall be present in the area where work is being performed and observe the work irregularly scheduled as required or as needed.

3.02 TESTING AGENCY AND INSPECTORS DUTIES AND RESPONSIBILITIES

- A. See Section 01 40 00 – Quality Requirements, for general duties and responsibilities of the testing agency and inspectors.

3.03 CONTRACTOR DUTIES AND RESPONSIBILITIES

- A. See Section 01 40 00 – Quality Requirements, for the duties and responsibilities of the Contractor.

3.04 STATEMENT OF SPECIAL INSPECTIONS

- A. See the appended Statement of Special Inspections following this Section, for the scope of building code and AHJ required testing and inspections for this Project.

END OF SECTION

Statement of Special Inspections

Southern Maine Community College
Healthcare Science Center Renovations

8 May 2026
Construction Documents

Project	SMCC Health Science Center	
Location	79 Ford Road South Portland, ME 04106	
Owner	Southern Maine Community College 2 Fort Road South Portland, ME 04210 Contact: Mitchell Boden, Project Manager	Tel: 207-741-5940
Architect of Record (AOR) & Registered Design Professional in Responsible Charge (RDP)	Richard R Pizzi, AIA, CEO richard.pizzi@lbpa.com Lavallee Brensinger Architects 155 Dow St. Manchester, NH	Tel: 603-935-4220
Structural Engineer of Record (SER)	David P. Martin, P.E. dmartin@fbra.com Foley, Buhl, Roberts & Associates Inc 254 Commercial St. Portland, ME	Tel: 207-200-2500
Testing Agency (TA)	To be determined	
Geotechnical Engineer (GE)	n/a	
Specialty Engineer(s) (SE)	See Performance Specifications on Page 2	

This Statement of Special Inspections is submitted as a condition for issuance of a building permit in accordance with Section 1704 of the International Building Code (IBC) 2021, as referenced by the Maine Uniform Building and Energy Code.

The firms, agencies, or individuals noted above (hereafter referred to collectively as agents) will perform the structural tests and inspections as specified herein.

A final letter shall be issued by the Testing Agency following the completion of all work in this Document stating that all items have been inspected and all deficiencies have been corrected.

The complete set of Contract Documents (Drawings and Specifications) that accompany the application for building permit is to be considered attached to this program as reference material.

This program does not relieve the Contractor of their responsibility to conduct the work in accordance with the requirements of the Construction Documents, the approved Shop Drawings and the Maine Uniform Building and Energy Code.

Statement of Special Inspections
Southern Maine Community College
Healthcare Science Center Renovations

8 May 2026
Construction Documents

Construction Categories: The following construction categories are included in the Statement of Special Inspections for this project. Specific tests and inspections required for each designated category are listed on the page noted opposite the category.

<u>Construction Category</u>	<u>Page</u>	<u>Construction Category</u>	<u>Page</u>
Fireproofing	<u>3</u>	Firestopping	<u>4</u>
Steel Stairs & Handrails/Guardrails	<u>5</u>		

Performance Specifications: The following construction components are designated in the Contract Documents on the basis of a performance specification to be designed by the Contractor's or Subcontractor's registered professional engineer, i.e. Specialty Engineer (SE).

<u>Construction Component</u>	<u>Page</u>
Steel Stairs & Handrails/Guardrails	<u>5</u>

Reports: Test and inspection reports prepared by the AOR, SER, TA, GE, and SE will be collected and maintained by the RDP and distributed, according to the procedures established by the Building Official. Prior to the issuance of a certificate of occupancy the RDP will submit a final letter to the Owner and Building Official in accordance with IBC 1704.2.4.

Prepared by the SER:

Registered Design Professional in Responsible Charge:

Name: David P. Martin, P.E
Maine P.E. Registration #15763

Name: Richard R Pizzi, AIA
Maine Registered Architect #3807

Signature: _____

Signature: _____

Firm: Foley Buhl Roberts & Associates, Inc.

Firm: Lavallee Brensinger Architects

Date: _____

Date: _____

Fireproofing (IBC 2021 Sections 1705.16) (Specification Sections 07 81 00 and 07 84 00)					
Item	Tests / Inspections	Code, Standard, or Document Reference	Agency	Type of Inspection ^{1,2}	Frequency
1. Materials Certification	Review materials certifications for conformance to Specifications	IBC 1705.16 Spec. Section 078100 and 078123	AOR	-	Each submittal
	For record and use in field verification	ASTM E605 ASTM E736	TA	Periodic	In conjunction with related field visits
2. Sprayed Fire-Resistant Materials	- Inspect and test sprayed fire-resistant materials applied to floor/roof assemblies and structural members in accordance with ASTM E605 and ASTM E736, based on the fire-resistance design as designated in the Construction Documents. Inspections shall include: - Condition of substrates - Thickness of application - Density - Bond strength adhesion/cohesion - Condition of finished application	IBC 1705.16 Spec. Section 078100 ASTM E605 ASTM E736	AOR & TA	Periodic	<u>Structural Members:</u> - Thickness: 4 measurements per 1,000 square feet of sprayed area of each assembly at each story or portion thereof - Density: 1 measurement per 2,500 square feet of sprayed area of each type of member at each story - Bond Strength: 1 measurement per 2,500 square feet of sprayed area of each type of member at each story

¹Continuous Inspection: Full-time observation of the indicated work by approved individual of the noted Agency, as the work is being performed.

²Periodic Inspection: Part-time or intermittent observation of the indicated work by an approved individual of the noted Agency and an inspection of the completed work.

Statement of Special Inspections
Southern Maine Community College
Healthcare Science Center Renovations

8 May 2026
Construction Documents

Firestopping (IBC 2021 Section 1705.18) (Specification Section 07 84 00)					
Item	Tests / Inspections	Code, Standard, or Document Reference	Agency	Type of Inspection ^{1,2}	Frequency
1. Material Certification. Test data for each firestop assembly	Review for conformance with the Contract Documents	Construction Document Spec. Section 07 84 00	TA AOR	-	Each submittal
2. Installer certification	Review of installer qualifications	Construction Document Spec. Section 07 84 00	AOR		Once
3. Installation of firestopping	- Verify materials for conformance with listed systems, prior to installation. - For each type of system installed, witness 10% of the installations. - Verify that all firestops have been installed. - Verify proper in-place labeling. Identify non-compliant installations and re-inspect following repair/replacement.	IBC 1705.18 Spec. Section 078400 ASTM E 2174 and E2393	AOR & TA	Periodic	At all locations

¹Continuous Inspection: Full-time observation of the indicated work by approved individual of the noted Agency, as the work is being performed.

²Periodic Inspection: Part-time or intermittent observation of the indicated work by an approved individual of the noted Agency and an inspection of the completed work.

Stairs and Railings (Specification Section 05 51 00)					
Item	Tests / Inspections	Code, Standard, or Document Reference	Agency	Type of Inspection ^{1,2}	Frequency
1. Steel Stairs & Handrail/Guardrail Assemblies	Review supplier's structural design of stair pans, stringers, landings, and railings.	Construction Documents Spec. Section 055000	SER	-	Each submittal
2. Materials Certification	Review certification of materials.	Construction Documents Spec. Section 055000	SER & TA	-	Each submittal
3. Installation of Steel Stairs & Handrail/Guardrail Assemblies	- Inspect installation of steel stairs. - Check component type, size, spacing, and placement for conformance with the approved stair system design. - Check member-to-member connections and connections to adjacent steel/concrete support elements.	AWS D1.1 AISC 360 NAAMM Metal Stair Manual and Pipe Railing Manual Construction Documents Spec. Section 055000	TA	Periodic	All locations
			SE	-	Once during performance of the work and once after completion of the work
			SER	-	During aperiodic site visits

¹Continuous Inspection: Full-time observation of the indicated work by approved individual of the noted Agency, as the work is being performed.

²Periodic Inspection: Part-time or intermittent observation of the indicated work by an approved individual of the noted Agency and an inspection of the completed work.

SECTION 01 50 00
TEMPORARY FACILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary utilities.
- B. Temporary telecommunications services.
- C. Temporary sanitary facilities.
- D. Temporary Controls: Barriers, enclosures, and fencing.
- E. Security requirements.
- F. Vehicular access and parking.
- G. Waste removal facilities and services.
- H. Project identification sign.
- I. Field offices.

1.02 RELATED REQUIREMENTS

- A. Section 01 00 00 - General Requirements.
- B. Section 01 40 00 - Quality Requirements.

1.03 QUALITY ASSURANCE

- A. Comply with NFPA 241 Building Construction and Demolition Operations, ANSI A10 Safety Requirements for Construction and Demolition, AGC and ASC industry recommendations, and other applicable standards.
 - 1. Temporary electrical service shall comply with NECA Temporary Electrical Facilities, NEMA, UL and NFPA 70 National Electric Code.
- B. At the earliest time, when acceptable to the Owner, change over room use of temporary service to use of the permanent service.
- C. Operate temporary service and facilities in a safe and efficient manner, taking necessary fire prevention measures.

1.04 TEMPORARY UTILITIES

- A. Provide and pay for all drainage and stormwater, electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.
- B. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.05 TELEPHONE SERVICES

- A. Provide, maintain, and pay for telephone service to field office at time of Project mobilization.
- B. Telecommunications services shall include:
 - 1. Personal computer dedicated to project telecommunications, with necessary software and laser printer.
 - 2. Telephone Land Lines: One line, minimum; one handset per line.
 - 3. Internet Connections: Minimum of one; DSL modem or faster.
 - 4. Email: Account/address reserved for project use.

1.06 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Use of existing facilities is not permitted.
- C. New permanent facilities may not be used during construction operations.
- D. Maintain daily in clean and sanitary condition.

1.07 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
- C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.08 FENCING

- A. Provide 6-foot-high fence around construction site; equip with vehicular and pedestrian gates with locks.
- B. Submit fence layout for review by the Owner for coordination of Owner activities. Review fence layout with AHJ to ensure emergency access and egress procedures are maintained throughout the construction process.
- C. Contractor is solely responsible for safety and security measures.

1.09 EXTERIOR ENCLOSURES

- A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.10 SECURITY

- A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.
- B. Coordinate with Owner's security program.

1.11 VEHICULAR ACCESS AND PARKING

- A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
- B. Coordinate access and haul routes with governing authorities and Owner.
- C. Provide and maintain access to fire hydrants, free of obstructions.
- D. Provide means of removing mud from vehicle wheels before entering streets.
- E. Designated existing on-site roads may be used for construction traffic.
- F. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking. Coordinate available parking areas with Owner.

1.12 WASTE REMOVAL

- A. See Section 01 74 19 - Waste Management, for additional requirements.
- B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- C. Provide containers with lids. Remove trash from site periodically.
- D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.13 PROJECT IDENTIFICATION

- A. Provide project identification sign.
- B. Erect on site at location approved by Owner and governing authorities.
- C. No other signs are allowed without Owner permission except those required by law.
- D. Size: 8' x 4' (unless otherwise required by local authorities) The Contractor shall be required to furnish and erect the Project sign complete in all respects, and to dismantle when so instructed by the Owner.
- E. Content: Display names and addresses of the Project, Owner, Architect, and Contractor. Graphics, text, lettering, colors, and location shall be provided by the Architect and approved by the Owner, at a later date.
- F. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors. Do not permit installation of unauthorized signs. No other signs or advertisements shall be displayed on the premises without the approval of the Owner.

1.14 FIELD OFFICES

- A. The Contractor shall provide and maintain an insulated, weather tight, field office at the site. The office shall be of sufficient size to accommodate required office personnel and meeting place for six people. Provide electrical service, heat, lighting, telephone, fax machine, and personal computer, Internet connected with e-mail capability and printer. At a minimum, furnish with a desk and chair for each Superintendent, conference table and chairs, 4-drawer file cabinet, plan table, plan rack, and bulletin board. Equip with a water cooler and first aid cabinet unit. Existing facilities and/or new construction shall not be available for this purpose.
- B. Temporary offices shall be maintained until the issuance of a Certificate of Substantial Completion and shall be removed when no longer required. The Contractor shall pay all costs in connection with the construction, servicing, maintenance, and removal of temporary offices.
- C. Provide space for Project meetings, with table and chairs to accommodate 6 persons.
- D. Locate offices a minimum distance of 30 feet from existing and new structures.

1.15 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.
- B. Clean and repair damage caused by installation or use of temporary work.

PART 2 PRODUCTS

2.01 PRODUCTS

- A. Tarpaulins: Waterproof, fire-resistant, UL labeled, with flame spread rating of 15 or less.
- B. Water: Potable water.
- C. Fencing: Shall be galvanized two (2) inch chain link fabric not less than six (6) feet high with galvanized steel pipe posts.

PART 3 EXECUTION

3.01 GENERAL

- A. Review locations of temporary facilities, equipment, and storage with the Architect and Owner, for the Owner's approval.
- B. Use qualified personnel for the installation of temporary facilities. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY UTILITY INSTALLATION

- A. Temporary Water Service: The Contractor shall:

1. Provide and maintain a temporary water service or install the permanent water service as required for the proper execution of the Work. Such service shall be installed in a manner approved by governing authorities.
 2. Pay for the installation and removal of any temporary service, and for all water used throughout the construction period.
 3. Pay for permits, if applicable, as required by governing authorities. Obtain easements across private property if required.
 4. Extend a supply adequate for all construction purposes and convenient to all trades.
 5. Protect lines against freezing and be fully responsible for the temporary installation in every way.
 6. Provide backflow preventer(s), vacuum breakers, etc., as required to protect water systems from contamination.
 7. Provide any and all hose needed. All service hoses shall be bubble-tight at all times. Trigger operated nozzles shall be used to reduce water waste. No leakage shall be acceptable. Remove all temporary equipment and materials completely upon completion of construction
 8. Repair all damage caused by use of temporary or permanent water services.
- B. Temporary Electrical Services: The Contractor shall:
1. Provide and maintain temporary light and power as required for the proper execution of the Work. Such service shall be installed and maintained in conformance with NEMA, NECA, UL standards for temporary electric service, National Electric Code and in a manner approved by governing authorities and local utility regulations.
 2. Pay for the installation and removal of any temporary service, and for all electricity used throughout the construction period.
 3. Pay for permits, if applicable, as required by governing authorities. Obtain easements across private property if required.
 4. Extend a supply of temporary lighting and power adequate for all construction purposes and convenient to all trades.
 5. Accept full responsibility for the temporary installation in every way. Remove all temporary equipment and materials completely upon completion of construction.
 6. Whenever overhead floor or roof deck has been installed, provide temporary lighting with local switching. Install and operate temporary lighting that will fulfill security and protection requirements, without operating the entire system, and will provide adequate illumination for construction operations and traffic conditions. Provide a minimum of one (1) lamp per story at interior stairways and ladder runs, located to illuminate each landing and flight.
 7. Determine that construction use of power will not affect the operation or performance of any equipment or appliances within the existing building.
- C. Temporary Drainage and Storm Water Control: The Contractor shall provide drainage ditches, dry wells, stabilization ponds, and similar facilities. Filter out excessive amounts of soil, construction debris, chemicals, oils and similar contaminants that might clog sewers or pollute waterways before discharge. Maintain temporary drainage facilities in a clean, sanitary condition. Following heavy use, restore normal conditions promptly. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains. Protect site from puddling or running water. Provide water barriers as required to protect site and abutting properties from soil erosion.
- D. Sanitary Facilities: The Contractor shall provide and maintain in a sanitary condition temporary toilet, wash facilities and drinking water fixtures complying with regulations and health codes for the type, number, location, operation and maintenance of fixtures and facilities.
1. Toilets shall be enclosed, weather-tight chemical type for the use of all construction personnel at locations acceptable to the Owner and governing authorities. Toilet facilities within existing buildings may not be used by construction personnel. Permanent toilets installed under this Contract shall not be used during construction.

2. Drinking water facilities shall be containerized tap-dispenser bottled water units, with paper cups.
 3. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Provide covered waste container for used materials. Maintain daily in clean and sanitary condition.
- E. Temporary Heat: The Contractor shall provide temporary heat to permit construction work to be carried on during the winter months and as required by construction activities for curing or drying of completed installations or protection of installed construction from adverse effects of low temperatures or high humidity. These Specifications are not to be construed as requiring heat for operations that are not adversely affected by the weather.
1. The Contractor shall maintain a minimum temperature of 40 degrees F at the working surface, unless higher temperatures are required for specific work activities. This provision does not supersede any specific requirements for methods of construction, curing of materials, or the applicable General Conditions set forth in the Contract Documents with added regard to performance obligations of the Contractor.
 2. During the progress of the Work and at all times prior to the date of Substantial Completion, the Contractor shall provide temporary heat as required to prevent damage to completed work, work in progress or stored materials.
 - b. The Contractor shall provide independent temporary heating systems and shall pay all costs, including fuel, related thereto.
 3. The Contractor may NOT use the permanent new heating system as specified for the project.
- F. Operating labor shall be provided by the Contractor for all heating equipment. Operating labor shall include frequent inspection, emergency repairs, and maintaining temperature records. The Contractor shall provide continuous direct attendance as appropriate or otherwise required by governing authorities.
1. The installation and operation of heating devices used hereunder shall comply with all safety regulations, including provisions for adequate ventilation and fire protection. Select safe equipment that will not have a harmful effect on completed installation or elements being installed. Coordinate ventilation requirement to produce the ambient condition required and minimize consumption of energy. Use of gasoline burning space heaters, open flame, or salamander type heating units is prohibited. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes vapors, or gases.
- G. Temporary Ventilation: Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

3.03 TEMPORARY SUPPORT FACILITIES INSTALLATION

- A. Storage Sheds and Trailers: Existing facilities and/or new construction shall not be available for this purpose.
1. All field offices, storage sheds, and trailers located within the construction area, or within 30 feet of building lines shall be of non-combustible construction, complying with requirements of NFPA 241.
 2. Construction shanties, sheds, and temporary facilities provided as required above or for the Contractor's convenience shall be located as approved by the Owner and governing authorities and maintained in good condition and neat appearance.
- B. Temporary Roads and Parking: Construct and maintain temporary roads to adequately support loading and withstand exposure to traffic during the construction period. If possible, locate temporary roads, storage areas, and parking where the same permanent facilities will be located. Coordinate temporary road development with sub-grade grading, compaction, installation and stabilization of sub-base, and installation of base and finish coats of permanent paving. Extend temporary roads in and around the construction area as necessary to accommodate delivery and storage of material, equipment usage, administration, and supervision. Plan installation of the final course of permanent paving after all heavy truck traffic

and immediately before Substantial Completion. Coordinate with weather conditions to avoid unsatisfactory results.

- C. Temporary Traffic Control: Provide temporary traffic control at the junction of temporary roads with public roads, including, but not limited to, warning signs for public traffic and "STOP" signs for entrance onto public roads. Comply with requirements of local or state traffic authorities. Provide all necessary equipment, flag people, or special police, as required by traffic authorities having jurisdiction.
- D. Temporary Stairs, Lifts, and Hoists: The Contractor shall furnish and maintain all equipment such as temporary stairs, ladders, ramps, scaffolds, runways, chutes, etc., as required for the proper execution of the Work, unless specifically included under the Work of other trades.
 - 1. All such apparatus, equipment, and construction shall meet all requirements of applicable laws, regulations, and standards of safety and good practice.
 - 2. Until permanent stairs are available, provide temporary stairs where ladders are not adequate. As soon as permanent stairs are erected, the Contractor shall provide temporary protective treads, and handrails.
 - 3. All hoisting equipment and machinery required for the proper and expeditious prosecution and progress of the Work shall be furnished, installed, operated, and maintained in safe condition by the Contractor for the use of all subcontractors' material and/or equipment delivered to the designated hoisting area. All costs for such equipment operating services shall be paid by the Contractor.
 - 4. In the event that a particular subcontractor has certain specific requirements which are peculiar to his needs, and which cannot be satisfied with the hoist provided by the Contractor, the subcontractor shall provide, maintain, operate, and pay for hoisting equipment necessary for the proper execution and completion of his work.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Temporary Fire Protection: Until fire protection needs are supplied by permanent facilities, the Contractor shall provide and maintain in good operating condition temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses, and as recommended by representatives of the fire insurance company carrying insurance on the Work or by governing fire or building authorities. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations".
 - 1. Flammable products shall be properly stored in containers acceptable to fire officials.
 - 2. The area within the site limits shall be kept orderly and clean, and all combustible rubbish shall be promptly removed from the site.
 - 3. Fire extinguishers shall be located where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stair well.
 - 4. Maintain unobstructed access to fire extinguishers, temporary fire protection facilities, stairways, and other access routes for fighting fires.
 - 5. Smoking shall be strictly prohibited on the construction site.
 - 6. Provide supervision of welding operations, soldering operations, combustion type temporary heating units, and similar sources of fire ignition.
- B. Barricades, Warning Signs and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed provide lighting, including flashing red or amber lights.
- C. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted, or that other undesirable effects might result. Minimize the use of tools and equipment that produce excessive noise and restrict their use to hours that will minimize complaints from persons near the site.

- D. Temporary Enclosures: Provide temporary enclosure for protection of construction in progress and completed, from exposure, foul weather, other construction operations, and similar activities.
 - 1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilation and material drying or curing requirements to avoid dangerous conditions and effects. This protection shall provide adequate working areas during winter months, consistent with the approved construction schedule to permit the continuous progress of all work necessary to maintain an orderly and efficient sequence of construction operations.
 - 2. Install tarpaulins securely, with non-combustible wood framing and other materials. Close openings 25 sq. feet or less with plywood or similar materials.
 - 3. Close openings through floor or roof decks and horizontal surfaces with load-bearing temporary construction. Where temporary wood or plywood is used and exceeds 100 sq feet in area, use fire-retardant treated framing and plywood.
- E. Protective Covering of the Work: The Contractor shall protect all finished surfaces, including the jambs and soffits of all openings used as passageways or through which materials are handled, against any possible damage resulting from the conduct of work by all trades.
 - 1. All finished surfaces, including factory-finished and job-finished items, shall be clean and not marred upon delivery of the building to the Owner. The Contractor shall, without extra compensation, refinish all spaces where such surfaces prove to have been inadequately protected and are damaged.
 - 2. Tight wood sheathing shall be laid under any materials that are stored on or moved over finished surfaces. Reinforced non-staining kraft building paper and plywood or planking shall be laid over all types of finished floor surfaces in traffic areas before moving any material over these finished areas. Wheelbarrows, if used over such areas, shall have rubber-tired wheels.
 - 3. Roof surfaces shall not be subjected to unnecessary traffic nor shall they be used for storage of material. Wherever such activity must take place in order to carry out the Work of the Contract, adequate protection shall be provided.
 - 4. Prohibit traffic on grass and landscaped areas.
- F. Temporary Tree and Plant Protection: The Contractor shall provide temporary fencing adequate to properly protect existing trees to remain specifically identified on the Drawings during construction. Fencing shall be located at each tree's drip line in order to protect the tree's root structure as well as its trunk and branches. Damaged trees shall be replaced in-kind at the Contractor's expense.
- G. Worker I.D. Badges: The Contractor shall provide worker I.D. badges for all personnel present on the site involved with the Project. A list shall be maintained in the field office, identifying workers with their assigned badge number. Badges shall be prominently displayed at all times when on-site.

3.05 TERMINATION AND REMOVAL

- A. Remove temporary facilities when the need has ended, or when replaced by authorized use of permanent facilities.
- B. Materials and facilities that constitute temporary facilities are the property of the Contractor.
- C. Remove temporary roads that are not intended or acceptable for integration into permanent roads. Remove soil and fill that does not comply with requirements for fill in these areas. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials. Repair or replace street paving and curb at the temporary entrances, as required by the governing authority.

- D. At Substantial Completion, clean and restore permanent facilities that have been used during construction, including but not limited to, replacing air filters, cleaning ductwork, and replacing lamps affected by substantial use.

END OF SECTION

SECTION 01 57 21
INDOOR AIR QUALITY CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Construction procedures to promote adequate indoor air quality after construction.

1.02 PROJECT GOALS

- A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.
 - 1. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.
 - 2. Establish condition of existing ducts and equipment prior to start of alterations.
- B. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.
 - 1. Furnish products meeting the specifications.
 - 2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

1.03 RELATED REQUIREMENTS

- A. Section 01 40 00 - Quality Requirements: Testing and inspection services.

1.04 REFERENCE STANDARDS

- A. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2012.thj 2015 amendments.
- B. ASHRAE Std 62.1 - Ventilation For Acceptable Indoor Air Quality; 2012.
- C. ASHRAE Std 129 - Measuring Air-Change Effectiveness; 1997 (Reaffirmed 2002).

1.05 DEFINITIONS

- A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.
- B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.
- C. Particulates: Dust, dirt, and other airborne solid matter.
- D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Low VOC Materials: See other sections for specific requirements for materials with low VOC content.
- B. Auxiliary Air Filters: MERV of 8, minimum, when tested in accordance with ASHRAE 52.2.

PART 3 EXECUTION

3.01 CONSTRUCTION PROCEDURES

- A. Prevent the absorption of moisture and humidity by adsorptive materials by:
 - 1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry to the greatest extent possible.
 - 2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.

3. Provide sufficient ventilation for drying within reasonable time frame.
- B. Begin construction ventilation when building is substantially enclosed.
- C. If extremely dusty or dirty work must be conducted inside the building, shut down HVAC systems for the duration; remove dust and dirt completely before restarting systems.
- D. When working in a portion of an occupied building, prevent movement of air from construction area to occupied area.
- E. HVAC equipment and ductwork may NOT be used for ventilation during construction:
 1. Provide temporary ventilation equivalent to 1.5 air changes per hour, minimum.
 2. Exhaust directly to outside.
 3. HVAC ductwork shall be kept clean, free of dust during storage, handling and installation. Seal HVAC air inlets and outlets immediately after duct installation with tape and plastic sheeting. All seams in ductwork shall be sealed.
- F. All inspection and filter replacement shall occur with the HVAC equipment turned off.
- G. Do not store construction materials or waste in mechanical or electrical rooms.
- H. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.
 1. Inspect duct intakes, return air grilles, and terminal units for dust.
 2. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduit.
 3. Clean tops of doors and frames.
 4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.
 5. Clean return plenums of air handling units.
 6. Remove intake filters last, after cleaning is complete.
- I. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.
- J. Use other relevant recommendations of SMACNA IAQ Guideline for Occupied Buildings Under Construction for avoiding unnecessary contamination due to construction procedures.

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General product requirements.
- B. Re-use of existing products.
- C. Transportation, handling, storage and protection.
- D. Product option requirements.
- E. Substitution limitations and procedures.
- F. Procedures for Owner-supplied products.
- G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

- A. Section 01 00 00 - General Requirements.
- B. Section 01 30 00 – Administrative Requirements: Substitutions.
- C. Section 01 40 00 - Quality Requirements: Product quality monitoring.

1.03 SUBMITTALS

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project. See Section 01 30 00 - Administrative Requirements, for more information regarding product data submittals.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances. See Section 01 30 00 - Administrative Requirements, for more information regarding Shop Drawings.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.
- B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.
- C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.
- D. Reused Products: Reused products include materials and equipment previously used in this or other construction, salvaged and refurbished as specified.

2.02 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by the Contract Documents.
- B. Do not use products made using or containing CFC's or HCFC's.
- C. Where all other criteria are considered equal, Contractor shall give preference to products that:

1. Are extracted, harvested, and/or manufactured closer to the location of the project.
2. Have longer documented life span under normal use.
3. Result in less construction waste.

2.03 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers with product model: Use a product of one of the manufacturers named; no substitutions if so indicated; substitutions by following substitution procedures.
- C. Products Specified by Naming One manufacturer with other acceptable manufacturers listed without product model: Submit a request for substitution following substitutions procedures.

2.04 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual Specification Sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

- A. Substitutions are changes, modifications or deviations in those products, materials, equipment, and methods of construction required by the Contract Documents proposed by the Contractor after the receipt of Bids. Substitutions for the convenience of the Contractor or subcontractors, or materials suppliers will only be considered if submitted prior to the receipt of Bids, in strict conformance with the Instructions to Sub-bidders. The following shall not be considered substitutions:
 1. Changes, modifications, or deviations requested by Bidders during the bidding period and accepted prior to the receipt of Bids shall be considered as included in the Contract Documents and are not subject to the requirements of this Section.
 2. Revisions to Contract Documents requested by the Owner or Architect.
 3. Specified options of products or materials included in the Contract Documents.
 4. The Contractor's compliance with governing regulations and orders issued by governing authorities, subject to the Architect's prior written notice and approval.
- B. Substitution Requests: Request for substitution will be considered only if, in the opinion of the Architect, such substitution will be of benefit to the Owner. Substitution requests after receipt of bids will not be considered solely related to an "or approved equal" clause in the Contract Documents.
 1. The Contractor's substitution request will be considered by the Architect when all of the following conditions are satisfied, as determined by the Architect; otherwise requests will be returned without action.
 - a. Extensive revisions to the Contract Documents are not required.
 - b. Proposed changes are in keeping with the general intent of the Contract Documents.
 - c. The request is timely, fully documented and properly submitted.
 - d. In addition to the above conditions, one or more of the following conditions must be satisfied, as determined by the Architect. The Contractor shall provide written documentation for each condition noted.
 - 1) The specified product cannot be provided within the Contract Time. However, the request will not be considered if the specified product cannot be provided as a result of the Contractor's failure to submit to the Architect or order from the manufacturer in a timely fashion.
 - 2) The specified product cannot receive necessary approval of governing authority and the requested substitution can be approved.

- 3) A substantial advantage is offered to the Owner, in terms of cost savings, time savings, energy conservation, or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.
 - 4) The specified product cannot be provided in a manner that is compatible with or coordinated with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.
 - 5) The specified product cannot provide the warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provides the required warranty.
- C. Substitution Request Procedure: Complete the Contractor's Substitution Request form provided within Section 01 30 00 Administrative Requirements. In addition, the Contractor shall submit a side-by-side comparison summary showing each listed specification, testing requirement, etc. of the specified product and the proposed substitution product for review by the Architect. Submit electronically each request for substitution using the provided form with all required information. Incomplete forms will not be reviewed.
- D. Architect's Action: Within five (5) working days of receipt, the Architect will request additional information to evaluate the substitution if any is required. Within ten (10) working days of receipt of all necessary information, the Architect will notify the Contractor of acceptance or rejection of the proposed substitute. If a decision on the use of a proposed substitute is not or cannot be made or obtained within the time allocated, the Contractor shall use the specified product. Acceptance will be in the form of a Change Order.
- E. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this Section.
- F. A request for substitution constitutes a representation that the submitter:
1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 2. Will provide the same or better warranty for the substitution as for the specified product.
 3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
 4. Waives claims for additional costs or time extension that may subsequently become apparent.
- G. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

3.02 OWNER-SUPPLIED PRODUCTS

- A. Owner's Responsibilities:
1. Arrange for and deliver shop drawings, product data, certificates, manufacturer's instructions and samples, to Owner.
 2. Arrange and pay for product delivery to site in accordance with the progress schedule.
 3. On delivery, inspect products jointly with Contractor.
 4. Submit claims for transportation damage and arrange for replacement of damaged, defective, or deficient items.
 5. Arrange for manufacturers' warranties, inspections, and service.
- B. Contractor's Responsibilities:
1. Review Owner reviewed shop drawings, product data, and samples. Submit to the Architect with notification of any observed discrepancies or problems anticipated due to non-conformance with the Contract Documents.
 2. Designating delivery dates for each product in accordance with the progress schedule.

3. Receive and unload products at site; inspect for completeness or damage jointly with Owner. Record shortages, and damaged or defective items.
 4. Install blocking and supports as required for proper installation.
 5. Handle, uncrate, store, assemble, install, connect, adjust and finish products.
 6. Protecting products from damage and from exposure to the elements.
 7. After receipt, repair or replace items damaged the Contractor or persons under his control.
- C. Owner furnished equipment for installation by the Contractor may be indicated on the Drawings, or otherwise identified for the Contractor's information. Concealed wood blocking shall be provided for mounting equipment. See Section 06 10 00. Such equipment shall include, but not be limited to:

3.03 TRANSPORTATION AND HANDLING

- A. The Contractor shall be responsible for the proper protection from damage of all materials and equipment prior to and following their incorporation into the Work. Materials and equipment shall be inspected by the Contractor
- B. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- C. Transport and handle products in accordance with manufacturer's instructions.
- D. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- E. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, products are undamaged and if found to be damaged or otherwise unsuitable, shall be promptly rejected.
- F. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.
- G. Arrange for the return of packing materials, such as wood pallets, where economically feasible.
- H. All materials stored on or off the site shall be kept in secured, weathertight enclosures, and the Contractor shall correct, at no additional cost to the Owner, any damages resulting from his failure to provide proper protection. Such corrective work shall include total replacement if so required by the Architect.
- I. The Contractor shall exercise caution in temporarily loading materials on floors, decks, roofs, etc. It shall be the Contractor's responsibility to determine the size of loads to be imposed and the adequacy of the affected structure to support such loads. The Contractor shall correct, at no additional cost to the Owner, any resultant damages.

3.04 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- G. Prevent contact with material that may cause corrosion, discoloration, or staining.
- H. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

- I. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

CONTRACTOR'S SUBSTITUTION REQUEST

To Architect: _____ Date: _____
From Contractor: _____ Number: _____
Specification Section: _____ Page: _____
Article / Paragraph: _____

1. Product data for proposed substitution to include: Description of product, reference standards, performance, and test data.
Sample attached: Yes___ No___ To be sent if requested by Architect Yes___ No___
(BABAA) Build America, Buy America Act Compliant: Yes___ No___
2. Itemized comparison of proposed substitution with product specified is attached.

ORIGINAL PRODUCT	PROPOSED SUBSTITUTION

Trade Name, Model: _____	_____

Manufacturer: _____	_____

Installer: _____	_____

History of proposed substitution: New product ___ 2-5 years old ___ 5-10 years old ___ > 10 years old ___

Significant variations of proposed substitution from original product: _____

Proposed substitution affects other parts of the Work: No ___ Yes, explain _____

Similar installations within 150 miles: Provide project name, address, architect, install date: _____

Reason for not providing specified item: _____

3. Unit costs, if applicable: State if cost is materials only ___ or materials installed ____.

Original product \$ _____ per _____ Substitution \$ _____ per _____

Savings to Owner for accepting substitution: _____ \$ _____

Proposed substitution changes Contract Time: No ___ Yes ___ Add/Deduct _____ days.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior to the specified product.
- Same warranty will be furnished for proposed substitution as for the specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated herein is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions, functional clearances or design appearance.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Attachments: _____

SECTION 01 61 15
FASTENER REQUIREMENTS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. General requirements for fasteners.

1.02 GENERAL REQUIREMENTS

- A. Fasteners: "Fasteners" includes nails, screws, bolts, wedge bolts, expansion bolts, chemical bolts, epoxy anchors, pins, powder actuated devices, and all other types of mechanical connections.
- B. Completely Specified Fasteners: Where fasteners are completely specified in the Contract Documents, provide the specified fasteners.
 - 1. "Completely specified" means the fastener type, material, finish, size, diameter, length, and spacing are specified.
- C. Fasteners Not Completely Specified: Fasteners may not be completely specified in the Contract Documents:
 - 1. To allow the Contractor to control means, methods, and techniques of construction.
 - 2. When "Engineering By Contractor" is required.
- D. Fasteners Selected By Contractor: For fasteners not completely specified in the Contract Documents, the Contractor shall:
 - 1. Select fasteners appropriate for each condition, substrate, load, and exposure.
 - 2. Use fastener manufacturer's published load tables to determine fastener size and spacing.
 - 3. Provide a factor of safety of four or higher.
 - 4. Working load shall be maximum 25 percent of ultimate load capacity.
 - 5. Provide corrosion resistance at least equivalent to items being fastened.
 - 6. Obtain Architect's approval of each fastener prior to use.
 - 7. Install fasteners in compliance with the fastener manufacturer's recommendations.
- E. Fasteners for "Engineering by Contractor": Provide fasteners indicated on the approved, engineered shop drawings.
- F. Submittals: For each fastener used, submit manufacturer's data including load capacity, factor of safety, instructions, recommendations, and restrictions.

1.03 GENERAL REQUIREMENTS FOR STRUCTURAL FASTENERS

- A. Comply with fastener manufacturer's instructions, recommendations, and limitations.
- B. Working Load Capacity: Install each fastener to achieve the fastener manufacturer's published working load capacity.
 - 1. Working load capacity is not ultimate load capacity.
 - 2. Working load capacity, if not published, shall be maximum 25 percent of manufacturer's published ultimate load capacity.
- C. Torque: Torque each fastener within the min/max range recommended by fastener manufacturer.
- D. Fasteners Requiring Pre-drilling or "Pilot" Holes:
 - 1. Use only the fastener manufacturer's recommended coordinated drill bit diameter.
 - 2. Drill hole to depth recommended by fastener manufacturer.
 - 3. Clean holes prior to installation of fasteners.
 - 4. These are important requirements that significantly impact structural capacity.
- E. Quantity: As shown or, if not shown:
 - 1. Provide one fastener for each factory provided fastener hole in item being fastened.
 - 2. Provide at least two fasteners for each individual item being fastened.

3. Provide quantity to provide fastener working load capacity at least four times the actual load.

1.04 INSPECTING AND TESTING FASTENERS

- A. Contractor's Scope of Fastener Inspection and Testing: 100 percent of installed:
 1. Structural fasteners.
 2. Fasteners penetrating air barriers, water barriers, flashings.
- B. "Deficient Fastener" Definition: A fastener with one or more of these characteristics:
 1. Fastener is not the specified or approved fastener.
 2. Fastener is not the correct size, diameter, type, material, alloy, thread, finish, or appearance.
 3. Drive head is stripped.
 4. Threads are stripped.
 5. Fastener is broken or damaged.
 6. Fastener misses the intended framing or substrate.
 7. For light gage metal substrates, less than three threads penetrate completely through.
 8. Fastener cannot be tightened.
 9. Fastener cannot be torque to the fastener manufacturer's recommended torque.
 10. Fastener does not provide the intended or required load capacity.
 11. Required washers are missing.
 12. Visible appearance is damaged.

1.05 DEFICIENT FASTENER PROCEDURE

- A. Report deficient fasteners to Owner and Architect in writing with location photos and diagrams.
- B. Mark head of each deficient fastener bright red. Do not mark adjacent surfaces.
- C. Do not conceal deficient fasteners, until approved remediation is completed.
- D. Do not remove deficient fasteners, unless removal is part of approved remediation procedure.
 1. Removing deficient fasteners may cause unwanted holes, air infiltration, and water leaks.
- E. Propose remediation procedure to Owner and Architect including, without limitation:
 1. Removal of deficient fasteners.
 2. Replacement or correction of deficient fasteners.
 3. Restoration of damaged air barriers, flashings, sheathings, and related work.
- F. Execute approved remediation procedure.
- G. Re-inspect and retest every remediated fastener to prove the fastener is no longer deficient.

END OF SECTION

SECTION 01 71 00
CUTTING AND PATCHING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work Included in This Section:
 - 1. Provide all labor, materials, equipment and services, etc., required for all cutting (including excavation), removal, fitting, patching, and/or repairs as required to:
 - a. Make the several parts fit properly.
 - b. Uncover work to provide for installing, inspecting, or both, of ill-timed work.
 - c. Remove and replace work not conforming to requirements of the Contract Documents.
 - d. Remove and replace defective work.
- B. Related Work:
 - 1. In addition to other requirements noted or specified, upon the Architect's request uncover work to provide for observation by the Architect of covered work and remove samples of installed materials for testing.
 - 2. Do not cut or alter work performed under separate contracts without the Architect's written permission.

1.02 SUBMITTALS

- A. Where cutting and/or patching is required, the Architect's review of proposed cutting and patching procedures is required. The following information shall be included in the submission prior to proceeding with cutting:
 - 1. Clearly describe the extent of cutting and patching required and how it is to be performed. Layout the work on-site as appropriate. Indicate why it cannot be avoided.
 - 2. Describe the anticipated results in terms of changes to existing construction. Include changes to structural elements and operating components and changes in the building's appearance and other visual elements.
 - 3. List products to be used and firms that will perform the Work. Indicate dates for cutting and patching. Submit samples of actual materials to be used for patching.
 - 4. List any utilities that will be disturbed, relocated, made temporarily out-of-service, and indicate the length of service disruption.
 - 5. Where cutting and patching involves the addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.
- B. Acceptance of the cutting and patching proposal by the Architect does not waive the Architect's right to later require complete removal and replacement of Work found to be unsatisfactory, nor does it alter the Contractor's sole responsibility for the safe and proper execution of all cutting and patching.
- C. Submit written notice to the Architect designating the time the Work will be uncovered, to provide for the Architect's observation.

1.03 QUALITY ASSURANCE

- A. Structural Work: Do not cut and patch structural elements in a manner that would reduce their structural characteristics such as load-carrying capacity or load deflection ratio.
 - 1. Obtain approval of the cutting and patching proposal before cutting and patching structural elements, including but not necessarily limited to:
 - a. Foundation construction.
 - b. Bearing and retaining walls.
 - c. Structural concrete.
 - d. Structural steel.
 - e. Lintels.

- f. Structural decking.
 - g. Stair systems.
 - h. Miscellaneous structural metals.
 - i. Equipment supports.
 - j. Piping, ductwork, vessels, and equipment.
- B. Operational and Safety Limitations: Do not cut and patch operating elements or safety components in a manner that would reduce their capacity to perform as intended, or would increase maintenance, or decrease operational life or safety.
 - 1. Obtain approval of the cutting and patching proposal before cutting and patching operating elements or safety related systems, including but not necessarily limited to:
 - a. Shoring, bracing, and sheeting.
 - b. Primary operational systems and equipment.
 - c. Fire separation assemblies.
 - d. Fire-rated and non-fire-rated smoke barriers.
 - e. Water, moisture, or vapor retarders.
 - f. Membranes and flashings.
 - g. Fire protection systems.
 - h. Noise and vibration control elements and systems.
 - i. Control systems.
 - j. Voice, video, and data systems.
 - k. Conveying systems.
 - l. Electrical wiring systems.
- C. Miscellaneous: Do not cut and patch elements in a manner that would reduce their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
 - 1. Obtain approval of the cutting and patching proposal before cutting and patching building elements, including but not necessarily limited to:
 - a. Water, moisture or vapor barriers.
 - b. Membranes and flashings.
 - c. Noise and vibration control elements and systems.
 - 2. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace work cut and patched in a visually unsatisfactory manner.
- D. Remove, replace, patch and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void warranties.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. For replacement of items removed, use materials identical to existing materials.

2.02 PAYMENT FOR COSTS

- A. Perform cutting and patching needed to comply with the Contract Documents at no additional cost to the Owner.
- B. All costs resulting from ill-timed or defective work or work otherwise not conforming to the Contract Documents shall be borne by the Contractor.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

- A. Inspection: Inspect existing conditions, including elements subject to movement or damage during cutting, excavating, patching, and backfilling.
- B. After uncovering the work, inspect conditions affecting installation of new work.

- C. Prior to proceeding, meet with all 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.
- D. Discrepancies: If uncovered conditions are not as anticipated, immediately notify the Architect and secure needed directions. Do not proceed until unsatisfactory conditions are corrected.

3.02 PREPARATION PRIOR TO CUTTING

- A. Provide required protection including, but not necessarily limited to, shoring, bracing, and support to maintain structural integrity of the Work.
- B. Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Work that might be exposed during cutting and patching operations.
- C. Provide proper dirt, dust, fume, vapor, and noise control.
- D. Verify the conditions and requirements of all warranties that may be affected by cutting and patching (such as roofing warranties). It is the intent that all cutting and patching be performed in a manner that preserves all such warranties in full, without compromise.

3.03 PERFORMANCE

- A. General: Cutting and patching shall be kept to an absolute minimum by careful planning and through proper holes, sleeves, anchors, inserts, or other built-ins as the Work progresses.
- B. Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
- C. The Contractor shall properly restore work that has been cut or removed and install new products to provide completed work in accordance with the requirements of the Contract Documents.
- D. Cutting: Perform cutting and demolition by methods least likely to damage elements to be retained or adjoining construction and that will provide proper surfaces to receive installation of repair and new work. Where possible, review procedures with the original installer. Comply with the original installer's recommendations.
- E. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
- F. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
- G. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.
- H. Perform necessary excavating and backfilling as required under pertinent other Sections of these Specifications.
- I. By-pass utility services such as pipe or conduit, before cutting, where services are shown, or removal required, relocated, or abandoned. Cut off pipe or conduit in walls or partitions, to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.
- J. Patching: Perform fitting and adjusting of products as required to provide finished installations complying with the specified tolerances and finishes or otherwise satisfactory to the Architect.
- K. Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
- L. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
- M. Where the removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

- N. Where patching occurs in a smooth painted surface, extend final paint coat over the entire unbroken surface containing the patch, after the patched area has received primer and first coat.
- O. Patch, repair, or re-hang existing ceilings, as necessary to provide an even plane surface of uniform appearance.
- P. At penetrations in fire-resistive rated walls, partitions, ceilings, floors, or roof construction, completely seal voids with firestopping materials in compliance with Section 07 84 00 - Firestopping.
- Q. Unless otherwise indicated on the drawings, tooth in masonry at infill locations and allow for finished ends of units at cut locations.

3.04 CLEAN-UP

- A. All debris and rubbish shall be properly removed from the premises as it occurs. All materials shall be properly disposed of off-site, in strict accordance with all applicable Laws, Rules, Regulations, and Ordinances.
- B. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Completely remove paint, mortar, oils, putty, and similar items. Thoroughly clean surfaces before painting or finishing.

END OF SECTION

SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

- A. Owner requires that this project generate the least amount of trash and waste possible.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. Demolition debris and construction waste shall be sent to a certified recycling facility for sorting to recycle and reuse whenever possible. Any loads contaminated with municipal solid waste shall be taken to a municipal transfer station for off-loading and trucking to a certified recycling facility. Materials that cannot be recycled or reused shall be landfilled. It is expected that at least 75% of loads shall be diverted from landfills.
- E. Methods of trash/waste disposal that are not acceptable are:
 - 1. Burning on the project site.
 - 2. Burying on the project site.
 - 3. Dumping or burying on other property, public or private.
 - 4. Other illegal dumping or burying.
 - 5. Incineration, either on-site or off-site.
- F. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 DEFINITIONS

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- I. Return: To give back reusable items or unused products to vendors for credit.
- J. Reuse: To reuse a construction waste material in some manner on the project site.
- K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

- L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Monthly Reports: The certified recycling facility shall submit monthly reports of all project demolition debris and construction waste removed, recycled and landfilled. The report shall include:
 - 1. Date, disposal ticket #, materials type, total weight of the load, weight of material recycled from the load, % of materials recycled, materials destinations, tipping fees and disposal cost.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Manager: Designate a person who will be responsible for implementing the plan, instructing workers, coordinating waste materials handling, any on-site separation requirements for all trades and overseeing and documenting results of the Waste Management Plan.
- B. Facilities: Provide specific facilities for on-site containment and transportation of demolition debris and construction waste materials to off-site recycling and disposal facility for use by all contractors and installers
 - 1. Provide containers as required.
 - 2. Provide adequate space for pick-up and delivery of containers.
 - 3. Keep trash/waste bin areas neat and clean.
- C. Keep trash/waste collection areas neat and clean.
- D. Do not handle, separate, store, salvage, or recycle hazardous materials. Contact Owner if hazardous materials are encountered.

END OF SECTION

SECTION 01 78 00
PROJECT CLOSE-OUT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Substantial Completion procedures.
 - 1. Project Close-out meeting.
 - 2. Occupancy Permit.
- B. Project Record Documents.
 - 1. Record Drawings.
 - 2. List of Subcontractors and material suppliers.
 - 3. Operation and Maintenance Data.
 - 4. Warranties and bonds.
 - 5. Contractor's Certificate of No Hazardous Materials.
 - 6. Testing Agency Final Report.
- C. Architect's evaluation of the Work.
- D. Final Acceptance procedures.
- E. Operating and Maintenance Instructional Sessions.
- F. Adjustments.
- G. Final Cleaning.

1.02 RELATED REQUIREMENTS

- A. Section 01 00 00 - General Requirements.
- C. Section 01 00 30 - Electronic Media: Record Drawing backgrounds.
- D. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- E. Section 01 40 00 - Quality Requirements: Final Test Reports.
- F. Section 01 78 10 - Warranties: General warranty requirements.
- G. Individual Product Sections: Specific requirements for operation and maintenance data.
- H. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBSTANTIAL COMPLETION PRELIMINARY PROCEDURES

- A. Prior to requesting evaluation of the Work for certification of Substantial Completion, the Contractor shall complete the following items.
- B. Close-out Meeting: Not less than thirty (30) days prior to the anticipated date of Substantial Completion, the Contractor shall conduct a Project close-out meeting. Participants in the meeting shall include the Contractor, subcontractors, Owner and Architect. The Contractor shall prepare the agenda and schedule of close-out tasks, for prior distribution, which, among other items as may be determined by the Contractor, shall include the following:
 - 1. HVAC Start-up Activities.
 - a. Air and water balancing
 - b. Controls sequence check
 - c. HVAC filter replacement
 - d. Cleaning of ductwork used during construction.
 - e. Electrical and Mechanical Systems Final Testing
 - 2. Programming of Energy Management System
 - 3. Indoor Air Quality Testing (as applicable)
 - 4. Building Air-tightness Testing (as applicable)
 - 5. Testing and Inspections with Authorities Having Jurisdiction:

- a. Fire alarm system test
 - b. Sprinkler system testing
 - c. Certificate of Occupancy inspection
 - d. Other required Testing and Inspections
 6. Other Testing.
 - a. Security system
 - b. Data and Telephone distribution systems.
 7. Owner's Equipment Testing.
 - a. Telephone equipment
 - b. Computer network equipment
 - c. Audio-visual equipment
 - d. Laboratory Equipment provided by Owner
 8. Delivery of tools, spare parts, extra stock, etc.
 9. Punch Lists:
 - a. Contractor
 - b. Architect / Owner
 10. Final Cleaning Operations.
 11. Transition Security Issues.
 - a. Removal of construction trailers, fencing, gates, etc.
 - b. Door key change-over
 - c. Set-up key cabinet
 - d. Miscellaneous key turn-over (casework, millwork, toilet accessories, gas valves, etc.)
 - e. Activation of the security system
 12. Transition Issues.
 - a. Electric service change-over.
 - b. Telephone service change-over.
 - c. Insurance change-over.
 - d. Owner's schedule for move-in of furnishings and equipment
 13. Instructional Sessions:
 - a. Mechanical, sprinkler and electrical systems.
 - b. Domestic water system
 - c. Door hardware, windows, and window operators
 - d. Finish cleaning & maintenance
 14. Record Information:
 - a. Warranty binder
 - b. Record Drawings
 - c. Record survey
 - d. O&M manuals
 15. Close-out Paperwork:
 - a. Release of Liens
 - b. Consent of Surety
 - c. Certification of No Hazardous Materials
 - d. Testing Agency Final Report
 - e. Certificate of Occupancy.
- C. Adjust Contract Amount by Change Order to assess Owner for additional cost or savings due to increase or decrease in:
1. Savings accrued under the Guaranteed Maximum Price.
- D. Contractor's Punch List: Prior to preparation of a punch list by the Owner and Architect, the Contractor shall prepare his own comprehensive punch list, and along with his subcontractors, properly complete all Work items thereon. The receipt of the Contractor's written punch list, clearly identifying all completed and pending items, shall be considered a prerequisite for the commencement of the Owner and Architect's evaluation of the Work for Substantial Completion.

- E. Advise Owner of pending insurance and utility change-over requirements.
- F. Submit warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
- G. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities, including Occupancy Permits, operating certificates and similar releases. If the Project is completed in phases, obtain Occupancy Permits as required by governing authorities.
- H. Deliver tools, spare parts, extra stock, and similar items.
- I. Make final change-over for locks, keys, and other security provisions.
- J. Complete start-up testing of equipment and systems, conduct Owner's training sessions.
- K. Discontinue, change over and remove temporary facilities from the site. Remove temporary protection measures provided during construction.
- L. Final Cleaning.
- M. Certificate of Occupancy: The Contractor shall schedule various inspections with the Authority Having Jurisdiction as required to obtain a Certificate of Occupancy.

1.04 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
 - 1. Record Drawings: Shall be required for all Site Utilities, Site Drainage, Architecture, Building Structure, Plumbing Systems, Mechanical Systems, Fire Protection Systems and Electrical Systems.
 - a. The Contractor shall maintain one set of Contract Drawings for use in the preparation of Record Drawings. This set shall be maintained at the site, and upon them, the Contractor shall clearly and accurately record all Addenda, Supplementary Instructions, Change Orders, Architect's responses to Contractor's Requests for Information, and all significant changes made during construction to the Work hereinafter listed.
 - b. Upon completion of the Contract, and as a prerequisite to final Payment, the Contractor shall prepare (draft as necessary), check, and certify the Record Drawings for completeness and accuracy and submit them to the Architect. The Contractor's submittal shall include one set of CD Rom electronic media files and one set blackline hard copy Record Drawings. The Contractor shall imprint the following text on each Record Drawing and Record Drawing Electronic Media File:
 - 1) NOTE: This drawing has been produced by (name and address of contractor). It is not the originally designed Contract Document. It is a Record Drawing."
 - 2) See Section 01 00 30 - Electronic Media for information regarding obtaining electronic Contract Documents for use in preparing for Record Drawings.
 - c. The Architect will casually review such drawings but will in no way ascertain or certify their completeness or correctness, which shall remain the sole responsibility of the Contractor. The Architect shall be entitled to rely upon the thoroughness and accuracy of the Contractor's documents, without further verification. Following his review, the Architect will forward all Record Drawings to the Owner for his use.
 - 2. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work. Complete miscellaneous records, place in good order, properly identified and bound ready for reference and submit to the Architect for the Owner's records.
 - 3. List of Subcontractors: The Contractor shall submit to the Architect two (2) typed updated lists of all subcontractors, service organizations, and principal vendors, including names, addresses, and telephone numbers where they can be reached for emergency service at all times including nights, weekends, and holidays.
 - 4. Certificate of Occupancy.
- B. Operation and Maintenance Data:

1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
 3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
 4. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
1. The Contractor shall submit to the Architect two (2) typed sets, neatly bound and indexed in a loose leaf binder, of all warranties, certificates and bonds as required by the Contract Documents.
 2. For equipment or component parts of equipment put into service during construction with Owner's permission, submit a copy of documents within 10 days after acceptance.
 3. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 4. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period. Pages shall be pre-punched for insertion into the bound set.
- D. Contractor's punch list submission to Architect.

1.05 ARCHITECT'S EVALUATION

- A. On receipt of a written request from the Contractor, the Architect will either proceed with evaluation of the Work for Substantial Completion or advise the Contractor of requirements yet to be completed prior to evaluation.
- B. Based on his/her observations, the Architect will provide a written list, or "Punch List", of items to be corrected or to be completed. The Architect's list may not include all Work necessary for completion in accordance with the Contract Documents and shall not in any way relieve the Contractor of responsibility for compliance with the Contract Documents.
- C. The Architect shall prepare the AIA G704 Certificate of Substantial Completion form and attach his/her written evaluation list thereto.
- D. Additional Work found to be incomplete or not in conformance with the Contract Documents after the Architect's evaluation shall be completed or corrected before Final Acceptance and Final Payment.
- E. When Work has been completed or corrected, the Contractor shall submit to the Architect a written request for re-evaluation. Include a copy of the Architect's previous evaluation report with notation of action taken for each item.
- F. The Architect shall be responsible for one re-evaluation of their punch list, and only after the Contractor has completed 100% of the items on the initial list. Should additional visits by the Architect be required for more than one re-evaluation of the punch list per phase, the Contractor shall compensate the Architect (at the Architect's and Consulting Engineer's hourly rates plus mileage) for additional the visits.

1.06 FINAL ACCEPTANCE

- A. Within five (5) working days after the date of Substantial Completion, the Contractor shall provide a list of final Contract requirements with anticipated completion dates including:
 1. List of incomplete Work.
 2. Final Change Orders.
 3. Assurances that unsettled claims will be settled.
 4. Record Drawings, O& M Manuals, Final Project Photos, Damage or Settlement Survey or other final record information.

5. Final Application for Payment with releases and supporting documentation, including final waivers of lien.
 6. Written confirmation that corrective work related to any failed quality control testing has been provided, and that satisfactory retesting has been performed and approved by the testing agency.
- B. Re-evaluation Procedure: The Architect will re-evaluate the Work upon receipt of written notice from the Contractor that the Work, including correction of items previously noted, has been completed.
1. Upon completion of re-evaluation, the Architect will prepare a Certificate of Final Acceptance, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for Final Acceptance.
 2. If necessary, re-evaluation for Final Acceptance will be repeated. Cost of re-evaluation will be the responsibility of the Contractor.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 INDOOR AIR QUALITY MANAGEMENT

- A. The Contractor and his various subcontractors as he may direct shall implement the procedures throughout construction in an effort to improve indoor air quality during the Owner's occupancy. See 01 57 21 - Indoor Air Quality Controls.

3.02 BUILDING COMMISSIONING

- A. Mechanical and Electrical Systems Final Testing: The Contractor shall submit final performance acceptance reports prepared by licensed professional mechanical and electrical engineers as required by the Maine Energy Code. See Section 01 40 00 - Quality Services.

3.03 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
1. Drawings.
 2. Specifications
 3. Addenda.
 4. Change Orders and other modifications to the Contract.
 5. Reviewed shop drawings, product data, and samples.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Record Drawings: Legibly mark each item to record actual construction including:
1. Field changes of dimension and detail.
 2. Details not on original Contract drawings.

3.04 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.05 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
 - 1. Product data, with catalog number, size, composition, and color and texture designations.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

3.06 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 - 1. Description of unit or system, and component parts.
 - 2. Identify function, normal operating characteristics, and limiting conditions.
 - 3. Include performance curves, with engineering data and tests.
 - 4. Complete nomenclature and model number of replaceable parts.
- B. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- E. Provide servicing and lubrication schedule, and list of lubricants required.
- F. Include manufacturer's printed operation and maintenance instructions.
- G. Include sequence of operation by controls manufacturer.
- H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- I. Provide control diagrams by controls manufacturer as installed.
- J. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- K. Include test and balancing reports.
- L. Additional Requirements: As specified in individual product specification sections.

3.07 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Prepare instructions and data by personnel experienced in maintenance and operation of described products.
- D. Prepare data in the form of an instructional manual.
- E. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- F. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- G. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

- H. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- I. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- J. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.
- K. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages, house in plastic sleeves.
- L. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.
- M. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
 - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
 - 3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.
 - b. Air and water balance reports.
 - c. Certificates.
 - d. Photocopies of warranties and bonds.

3.08 SPARE PARTS AND MAINTENANCE PRODUCTS

- A. Provide spare parts, maintenance, and extra products in quantities as specified in individual Specification Sections. Deliver to the site and place in locations as directed by the Owner. Obtain receipts signed by Owner's Representative and submit copies to the Architect if so directed.

3.09 WARRANTIES AND BONDS

- A. See Section 01 78 10: Warranties, for additional information.
- B. Retain warranties and bonds until time specified for submittal.
- C. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.
- D. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
- E. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
- F. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

3.10 CERTIFICATE OF NO ASBESTOS

- A. See Section 01 30 00 - Administrative Requirements, for requirements for submission of Certificate(s) of No Asbestos.

3.11 FINAL TESTING REPORTS

- A. See Section 01 40 00 - Quality Services, for requirements for the Testing Agency's Final Report.

3.12 OPERATING AND MAINTENANCE INSTRUCTIONS / OWNER TRAINING

- A. Instructions: The Contractor and his subcontractors and suppliers shall jointly, thoroughly instruct the Owner's representative and maintenance personnel in the proper maintenance and operation of all materials and systems that require training for proper operation and/or regular maintenance as follows:
 - 1. Demonstrated and written detailed instructions shall be provided and reviewed for materials and systems listed in Substantial Completion Preliminary Procedures paragraph of this Section, shall include, but not be limited to:
 - a. Start-up and Shut-down procedures.
 - b. Emergency operations.
 - c. Noise and vibration adjustments.
 - d. Control sequences.
 - e. Troubleshooting.
 - f. Safety procedures.
 - g. Maintenance manuals.
 - h. Maintenance agreements.
 - i. Warranties.
 - j. Record Drawings.
 - k. Tools, spare parts, lubricants.
 - l. Cleaning, economy, and efficiency adjustments.
 - m. Fuels, and fuel conversion, if applicable.
 - n. Identification systems.
 - o. Hazards. Any operations that, if improperly performed, might endanger the building's occupants, or damage the building's equipment or contents.
 - 2. Video all demonstrations of operation and maintenance sessions, which shall be held at the completed facility to instruct the Owner in the proper operation of equipment and systems. Prior to final payment, deliver two (2) copies to the Architect for forwarding to the Owner.
 - 3. The Contractor shall obtain sign-off from the Owner for meeting with each installer or manufacturer's representative.
 - 4. For equipment or systems requiring seasonal operation perform demonstrations for the other season within six (6) months.

3.13 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation. For testing, adjusting, and balancing of HVAC systems see Division 25 - Mechanical.

3.14 FINAL CLEANING

- A. Final Cleaning: Upon the completion of the Work, the Contractor shall remove all tools, scaffolding, surplus materials, debris, and shall leave the Work "broom clean" or its equivalent. In addition to general broom cleaning, the Contractor shall employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Use products that are non-hazardous. Cleaning shall be in compliance with requirements of Section 01 73 40 - Indoor Air Quality and with all manufacturer's written instructions. The following cleaning shall be done just before inspection for certification of Substantial Completion and final acceptance of the Work:

1. Transparent Materials: Clean mirrors and glazing in doors and windows; remove paint and glazing compounds that are noticeably vision obscuring; wash and polish, taking care not to scratch materials. Replace chipped, scratched, or broken materials.
2. Ceiling and Wall Surfaces: Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, marks, fingerprints, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Carefully clean (vacuum) fabric type surfaces as recommended by manufacturer. Generally clean as required to leave in first class condition.
3. Flooring: Remove all temporary protection; remove all spots, soil and paint; and clean, shampoo, wax, and buff, etc. all ceramic tile, resilient flooring, base, and other floors in accordance with manufacturer's recommendations. Leave concrete floors broom clean. Vacuum carpeted surfaces.
4. Hardware: Clean and polish all hardware for all trades; this shall include removal of all paint stains, dust, dirt, etc.
5. All fixtures, equipment, doors, and door and window frames: Clean all surfaces per manufacturer's instructions, removing all stains, paint, dirt and dust.
6. Labels: Remove all labels that are not permanent.
7. Mechanical and Electrical Equipment: Wipe surfaces of equipment to be free of paint, dirt, and dust. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps. Replace burned-out lamps.
8. Roofs: Clean debris from roofs, scuppers, and drainage systems.
9. Site: Clean the building site and surrounding ground. All trash and rubbish shall be removed and properly disposed of off-site and in accordance with Section 01 74 19 Construction Waste Management. Sweep paved areas broom clean and remove stains and spills. Rake disturbed grounds that are neither paved nor planted, to a smooth even-textured surface.

END OF SECTION

SECTION 01 78 10
WARRANTIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Administrative and procedural requirements for warranties.

1.02 RELATED SECTIONS

- A. Section 01 00 00 - General Requirements.
- B. Section 01 78 00 - Project Close-out.
- C. Divisions 2 through 28 for specific Section requirements.

1.03 GENERAL

- A. Manufacturers' disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.
- B. "Standard Product Warranties" are preprinted written warranties published by individual manufacturers of particular products and are specifically endorsed by the manufacturer to the Owner.
- C. "Special Warranties" are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.04 WARRANTY REQUIREMENTS

- A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
- B. Reinstatement of Warranty: When Work covered by a warranty has failed and has been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.
- D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
 - 1. The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- E. Owner's Right of Refusal: The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.
- F. Commencement Date of Warranties: The Date of Substantial Completion designates the commencement date for warranties unless specifically indicated otherwise.
 - 1. Commencement of warranties for items not accepted shall not begin until after items have been accepted.

2. In the event that portions of a system are made operational, are in service for the benefit of the Owner for projects with phased occupancy, the entire system shall remain under warranty until the entire system is completed, operational and accepted.
 - a. At that time, a one (1) year total system warranty period shall begin.

1.05 SUBMITTALS

- A. Submit written warranties and bonds to the Architect in conformance with Section 01 78 00 - Project Close-out.
- B. When a special warranty is required from the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Architect for review by the Owner prior to final execution.
- C. Form of Submittal: At Final Completion, compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer.
 1. Verify the documents are in proper form, contain full information, and are notarized. Co-execute warranties when required.

1.06 SCHEDULE OF GUARANTEES, WARRANTIES, AND BONDS

- A. Guarantee: The Contractor shall guarantee the entire Work to be free from defective or improper work or materials and shall make good any damage due to such work or materials for a term of one year from the date of the satisfactory completion and acceptance of the Work. In general, the commencement date for warranties and guarantees shall be the date of Substantial Completion. Under no circumstances shall any warranties or guarantees for any individual or collective materials or items of equipment commence prior to the date of Substantial Completion. Extended guarantees or warranties shall be provided as specified elsewhere.
- B. Provide guarantees, warranties, and bonds on products and installations as specified in individual Sections.

END OF SECTION

SECTION 02 41 00
SELECTIVE DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Selective demolition of building elements for alterations purposes and as otherwise required for the complete and proper execution of the Work.
- B. The Work of this Section is not necessarily fully represented on the Drawings or specifically identified herein. The Contractor, either himself or through his various subcontractors, shall thoroughly review all available documents and shall visit the site and existing building prior to bidding, as required to fully satisfy himself as to the types, locations and quantities of demolition work required for the complete and proper execution of the Work. No pleas of misunderstanding resulting from the failure to adequately inspect existing conditions will be entertained and no additional expenses related thereto will be granted.

1.02 RELATED REQUIREMENTS

- A. Section 01 50 00 - Temporary Facilities: Site fences, security, protective barriers, and waste removal.
- B. Section 01 71 00 - Cutting and Patching
- C. Section 01 74 19 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

1.03 REFERENCE STANDARDS

- A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Site Plan: Showing areas for temporary construction and field offices.
- C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
 - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
 - 2. Identify demolition firm and submit qualifications.
 - 3. Include a summary of safety procedures.
- D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.05 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: Company specializing in the type of work required with a minimum of 5 years of documented experience.

PART 2 PRODUCTS

2.01 MATERIALS

- A. For replacement of Work removed, use materials that comply with the pertinent Sections of these Specifications. All other materials, not specifically described but required for a complete and proper job, shall be as selected by the Contractor, subject to the approval of the Architect.

PART 3 EXECUTION

3.01 SPECIAL REQUIREMENTS FOR DEMOLITION

- A. All methods, techniques and procedures of safety, shoring, barricading, protection, demolition, removal and disposal shall be left solely to the discretion and the responsibility of the

Contractor. Special attention shall be paid to the issues of safety and protection of existing construction and/or landscaping and site improvements to remain. The Contractor shall take all precautions necessary to prevent the movement, settlement, or failure of adjacent construction. See Section 01 00 00 - General Requirements, for additional information.

- B. The Contractor shall be responsible for compliance with all applicable Local, State and Federal environmental regulations, including but not limited to the National Emission Standard for Hazardous Air Pollutants, as enforced by the United States Environmental Protection Agency. It shall be the Contractor's responsibility to provide all inspections and notifications related thereto.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain and pay for all required permits and approvals required for demolition, hauling, dumping and in general, all activities related to the Work of this Section.
 - 2. Comply with applicable requirements of NFPA 241.
- B. The Contractor shall be alert to potential problems or dangerous conditions. He shall exercise caution during demolition or removal which may affect structural safety. He shall proceed only when he has fully satisfied himself that he has provided proper support, shoring, bracing, protection, and safety precautions.
 - 1. If uncovered conditions are not as anticipated, immediately notify the Architect and secure needed directions. Do not proceed in areas of discrepancy until all such discrepancies have been fully resolved.
 - 2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 3. Provide, erect, and maintain temporary barriers and security devices.
 - 4. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
 - 5. Conduct operations to minimize effects on and interference with structures and occupants.
 - 6. Do not close or obstruct roadways or sidewalks without permit.
 - 7. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
 - 8. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- C. Do not begin removal until receipt of notification to proceed from Owner.
- D. Protect existing structures and other elements that are not to be removed.
 - 1. Provide bracing and shoring.
 - 2. Prevent movement or settlement of adjacent structures.
 - 3. Stop work immediately if adjacent structures appear to be in danger.
- E. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- F. The Architect's Scope of Services and responsibilities exclude the investigation, discovery, detection, identification, presence, leakage, release, use, handling, disposal, encapsulation, abatement, treatment or removal of, or exposure of a person or persons to, hazardous materials, pollutants, contaminants, or disease transmitting organisms, pre existing or otherwise deposited at any time and in any form at the Project, including but not limited to volatile organic compounds, molds, fungus, bacteria, petroleum products, lead, asbestos or asbestos products, radon and electro-magnetic frequency radiation or other radiation. Should any such substances be encountered, the Owner and Architect shall be promptly notified, in writing.
- G. Perform demolition in a manner that maximizes salvage and recycling of materials.

1. Comply with requirements of Section 01 74 19 - Waste Management.
2. Dismantle existing construction and separate materials.
3. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

3.03 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 1. Verify that construction and utility arrangements are as shown.
 2. Report discrepancies to Architect before disturbing existing installation.
 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Separate areas in which demolition is being conducted from other areas that are still occupied.
 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 in locations indicated on drawings.
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
- D. Remove existing work as indicated and as required to accomplish new work.
- E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, Telecommunications, and data systems): Remove existing systems and equipment as indicated.
 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 3. Verify that abandoned services serve only abandoned facilities before removal.
 4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.
- F. Protect existing work to remain.
 1. Prevent movement of structure; provide shoring and bracing if necessary.
 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 3. Repair adjacent construction and finishes damaged during removal work.
 4. Protect existing spray-applied fireproofing. Patch and repair as specified.
 5. Patch as specified for patching new work.

3.04 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Remove from site all materials not to be reused on site; comply with requirements of Section 01 74 19 - Waste Management.
- C. Contractor shall leave the site in neat, clean and safe condition, with all appropriate barricades, fencing, warning signage, etc. securely in place, ready for subsequent work.
- D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 03 05 16
UNDERSLAB VAPOR BARRIER

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sheet vapor barrier under concrete slabs on grade.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Preparation of subgrade, granular fill, placement of concrete.
- B. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.03 REFERENCE STANDARDS

- A. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- B. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.04 REGULATORY REQUIREMENTS

All products and materials must be approved for sale in and meet local, State, and Federal regulations.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- D. Test Data: Submit report of tests showing compliance with specified requirements.
- E. Samples: Submit samples of underslab vapor barrier to be used.
- F. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction. Submit manufacturer's standard details for sealing of penetrations and termination of membrane.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Underslab Vapor Barrier:
 - 1. Water Vapor Permeance: Not more than 0.010 perms, maximum.
 - 2. Complying with ASTM E1745 Class A.
 - 3. Thickness: 15 mils.
 - 4. Products:
 - a. Stego Industries LLC; Stego Wrap Vapor Barrier.
 - b. W.R. Meadows; Perminator.
 - c.
 - d. Reef Industries; Griffolyn 15 Mil Green.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Accessory Products: Vapor barrier manufacturer's recommended tape, adhesive, mastic, termination bars, double sided sealant tape, etc., for sealing seams and penetrations in vapor barrier. Provide penetration prevention bases for support of reinforcement and form work without penetration of vapor barrier.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surface over which vapor barrier is to be installed is complete and ready before proceeding with installation of vapor barrier.

3.02 INSTALLATION

- A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E1643.
- B. Install vapor barrier under interior slabs on grade; lap sheet over footings and seal to foundation walls as indicated on drawings.
- C. Provide manufacturer termination bar and sealant tape at termination of membrane to foundation wall.
- D. Lap joints minimum 6 inches.
- E. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions.
- F. No penetration of vapor barrier is allowed except for permanent utilities.
- G. Repair damaged vapor retarder before covering with other materials.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 – GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this section.
- C. Coordinate work with that of all other trades affecting or affected by work of this Section. Coordinate with such trades to assure the steady progress of all work under the Contract

1.02 SECTION INCLUDES

- A. The work of this Section consists of all plain and reinforced concrete work as shown on the Drawings and as specified herein, and includes, but is not limited to the following:
 - 1. Furnishing, placing, curing and finishing of all plain and reinforced concrete work for the building and site.
 - 2. Furnishing and placing of reinforcing steel and related accessories.
 - 3. Installation of vapor retarder (barrier).
 - 4. Furnishing and installation of underslab insulation.
 - 5. Furnishing and installation of joint fillers.
 - 6. Furnishing and installation of joint sealants.
 - 7. Installation of embedded items furnished by others.
 - 8. Coordination with all other trades for location of all pipe sleeves, roof drains, floor drains, duct openings, keys, chases, electrical boxes and conduits, anchors, inserts, fastenings and other devices required by other trades.
 - 9. Hardening and sealing of exposed concrete floors.
 - 10. Coordination of floor slab finish requirements with flooring manufacturers and contractors.
 - 11. Leveling of concrete slabs with a self-leveling concrete underlayment if required to meet the specified tolerances.

1.03 RELATED SECTIONS

- A. Related work shall be performed under the following Sections:
 - 1. Section 03 35 13 CONCRETE FLOOR FINISHES
 - 2. Section 07 26 16 BELOW-GRADE VAPOR RETARDER.
 - 3. Section 07 21 00 THERMAL INSULATION.
 - 4. Section 07 90 00 JOINT PROTECTION.

1.04 CODES AND REFERENCES

- A. All work in this Section shall conform to the requirements of the Maine Uniform Building and Energy Code including, but not limited to, the References listed below:
 - 1. American Concrete Institute (ACI):
 - a. ACI 318 "Building Code Requirements for Structural Concrete",
 - b. ACI 301 "Specifications for Concrete Construction",

- c. ACI 305 "Guide to Presenting Reinforcing Steel Design Details",
 - d. and additional standards listed within.
- 2. Concrete Reinforcing Steel Institute (CRSI): standards listed within.
- 3. American Welding Society (AWS): standards listed within.
- 4. American Society for Testing and Materials (ASTM): standards listed within.
- 5. American Institute of Steel Construction (AISC): standards listed within.
- B. In case of conflict between the References and the Project Specification, or in the case of conflict between References, the more stringent shall govern.
- C. When compliance with any such References is specified herein for materials or a manufactured or fabricated product, the Contractor, if requested, shall furnish an affidavit from the manufacturer or fabricator certifying that the materials or product delivered to the job meets the requirements specified. However, such certification shall not relieve the Contractor from the responsibility of complying with any added requirements specified herein.

1.05 SHOP DRAWINGS AND SUBMITTALS

- A. Submit complete Shop Drawings and other submittals in accordance with the provisions of Section 01 30 00 SUBMITTAL PROCEDURES.
- B. Prior to preparing Shop Drawings, all existing dimensions and conditions shall be verified or determined in the field and any discrepancies shall be brought to the attention of the Architect prior to proceeding.
- C. Shop Drawing requirements:
 - 1. Reinforcement Shop Drawings: Prepare in accordance with ACI 315, "Guide to Presenting Reinforcing Steel Design Details" and show the following: finished concrete elevations and dimensions; reinforcement clearances; bending diagrams; assembly diagrams; locations and lengths of splices and laps; temperature and shrinkage reinforcement; construction joint locations; control joint locations (slabs on grade only); dimensions, grade designations and details of reinforcement and accessories; brick shelves and haunches; and embedded items furnished by other Sections. Show dowels on Shop Drawings of the concrete work to be placed first. Indicate suitable marks for placing bars. Except as otherwise noted, approval of Shop Drawings shall be for size and arrangement of components. Errors in dimensions shown on Shop Drawings shall be the responsibility of the Contractor.
 - 2. Check and coordinate cast in place concrete work with work of other trades. Shop Drawings shall indicate the size and location of all MEP penetrations (openings or sleeves) affecting concrete work.
- D. Other Submittals:
 - 1. Concrete Mix Design and Constituents: Submit a detailed list of concrete materials and corresponding sources, proposed for use in concrete for this project. Provide concrete mix design as specified in this Section. The Contractor shall retain the services of a qualified testing agency, approved by the Architect, to test aggregate and to prepare or review mix designs for each strength of concrete specified, and shall submit mix designs and test results to the Architect for approval. The costs of all such services shall be borne by the Contractor.
 - 2. Methods of Construction: Prior to starting work, submit summary of methods, sequence of construction, and type of equipment proposed for use for performing cast-in-place concrete work. This submission shall not relieve the Contractor of his responsibility for providing proper methods, equipment, workmanship and safety precautions.
 - 3. Samples/Manufacturer's Data: Submit samples and/or manufacturer's data of

materials, products, and equipment as noted herein, and as otherwise requested by the Architect: concrete constituents including admixtures; accessories for reinforcement; inserts; and other products listed within this Section.

4. Mill Test Certification: Prior to delivery of reinforcing steel or concrete to job site, submit certified mill test reports of reinforcing steel and cement, (including names and locations of mills and shops and analyses of chemical and physical properties) properly correlated to concrete to be used in this project. Test reports for reinforcing to be welded shall show that the steel meets AWS weldability requirements.
 5. Concrete Curing and Protection: Submit summary of methods proposed for curing and protection of concrete.
 6. Affidavit: Submit, upon request by Architect, manufacturer's and/or supplier's and/or installer's affidavit stating that material or product provided complies with the Contract Documents.
- E. Fabrication of any material or performing of any work prior to the final approval of the Submittals shall be entirely at the risk of the Contractor.
- F. Approval of Shop Drawings and Submittals shall be for general compliance with the Contract Documents. Any errors, omissions, or incorrect dimensions shown on the Shop Drawings shall be the responsibility of the Contractor. Corrections, modifications, or comments made by the Architect or Structural Engineer to details during the shop drawing approval process shall not be cause for schedule delay or additional cost to the Owner. The Contractor is responsible for furnishing and installing all materials called for in the Contract Documents. Review of the Shop Drawings and Submittals by the Architect shall not relieve the Contractor of this responsibility.
- G. Reproduction of structural plans, sections and details, and any like information by reprographic or electronic methods for use as Shop and Coordination Drawings is subject to the requirements of Section 011401 – ELECTRONIC RELEASE FORM. Reproduction of structural plans, sections and details, and any like information by reprographic or electronic methods for use as Shop and Coordination Drawings is subject to the following conditions:
1. The entity producing the Shop and Coordination Drawings (The "User") agrees to accept the reproduced information from Foley Buhl Roberts & Associates, Inc. without any warranties, guarantees and/or representations of any nature whatsoever regarding the correctness, dimensional and/or quantitative accuracy and/or completeness of any such information contained therein.
 2. The User further agrees that such information shall be used as reference material only for the production of Shop and Coordination Drawings for the referenced project to which this Specification applies and only for that project.
 3. The User further agrees to release, indemnify, hold harmless and defend Foley Buhl Roberts & Associates, Inc. with respect to any claims, costs (including the cost of litigation), losses, damages and/or liabilities which arise from (or related to) the use, misuse, modification, interpretation, misinterpretation and/or misrepresentation of the reproduced information.

1.06 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference to comply with requirements in Division 1.
1. Before submitting design mixes, discuss concrete design mix requirements and specified procedures outlined in this Section for ensuring quality of concrete materials. Representatives of each entity directly concerned with cast-in-place concrete shall participate, including the following: (1) Architect, (2) Owner, (3) Structural Engineer, (4) General Contractor or Construction Manager, (5) Concrete

- Subcontractor, (6) Owner's Testing Agency, (7) Ready-mix concrete supplier, and (8) Underslab vapor retarder, waterproofing and dampproofing subcontractor.
2. Review items such as: Statement of Special Inspection requirements, Testing Agency procedures for field quality control, curing and protection procedures, construction, control and isolation joints, joint filler strips, semi-rigid joint fillers, vapor-retarder installation, steel reinforcement installation, concrete finishing, slab flatness and levelness measurements, slab elevation survey, and concrete repair procedures.
- B. Testing and Inspections: All cast-in-place concrete materials, measuring, mixing, transportation, placing and curing under this Section shall be subject to inspection by the Architect, and/or by the Owner's Testing Agency.
1. A qualified Testing Agency for testing and inspection shall be selected by the Owner and shall be paid directly by the Owner.
 2. However, such inspection, wherever conducted, shall not relieve Contractor of his responsibility to furnish materials and workmanship in accordance with Contract requirements, nor shall inspector's acceptance of materials or workmanship prevent later rejection of same by the Owner or Architect if defects are discovered.
 3. Notify the Testing Agency of intent to place concrete at least 24 hours prior to the time of placement. The Contractor shall make all necessary accommodations and provide access for the Testing Agency to conduct the testing and inspection work required by the Statement of Special Inspections. Cooperate with the Testing Agency's work and provide assistance if requested for taking and storing samples. Provide storage facilities for concrete cylinders at the site. Facilities must protect cylinders from the effects of cold or hot weather.
 4. All reinforcing shall be inspected by the Testing Agency for grade, size, spacing, position, cleanliness, cover and support.
 5. Testing Agency shall confirm that the amount of water added to the concrete at the site does not exceed the amount held back at the plant, as recorded on the delivery ticket.
 6. Concrete shall be sampled at the point of discharge and be tested for quality control in accordance with the following standards:
 - a. ASTM C31: Making and Curing Concrete Test Specimens in the Field.
 - b. ASTM C39: Compressive Strength of Cylindrical Concrete Specimens.
 - c. ASTM C143: Slump of Hydraulic-Cement Concrete.
 - d. ASTM C172: Sampling Freshly Mixed Concrete.
 - e. ASTM C 231: Air content by Pressure Method.
 7. Concrete compression tests:
 - a. Compression tests shall consist of four (4) - 6" diameter by 12" long cylinders (or six (6) - 4" diameter by 8" long cylinders) for each test made, cured and tested by the laboratory during the progress of the job. At least one (1) test shall be made for each strength of concrete up to 50 cubic yards pour, and at least one (1) test per strength for each 50 cubic yards thereafter, unless otherwise directed by the Architect. For each test made, one (1) cylinder shall be tested at 7-days test sample age and two (2) 6" diameter cylinders (three (3) for 4" diameter cylinders) shall be tested at 28-day test sample age. One 6" diameter cylinder (or two 4" diameter cylinders) for each test shall be kept in the event that a 56-day sample age test is required due to low 28-day results. Concrete for each set of cylinders shall be from one (1) sample representative of the entire batch.
 - b. In addition to the above, the Architect or the Contractor may direct additional

control cylinders to be made, cured and tested to verify strengths for removal of forms, shoring or adequacy for curing or cold weather protection. In such instances, the cylinders shall be cured in the same environment as the area which the cylinders represent. All such additional work requested by the Contractor shall be at his own expense.

8. Evaluation of Compression Tests:
 - a. Architect has authority to order, for any strength of concrete, increase in cement content and mix redesign for remaining work of either:
 - (1) Average 7-day strength of any two consecutive tests representing a particular design strength of a class of concrete is less than 55 percent of specified strength; OR
 - (2) Average 28-day strength of any two consecutive tests representing particular design strength of a class of concrete is less than 90 percent of specified strength.
 - b. The strength level of a class of concrete shall be considered satisfactory if the following requirements are met:
 - (1) Averages of any three consecutive 28-day strength tests representing each class of concrete equal or exceed the specified strength (f'_c).
 - (2) Not more than 10 percent of 28-day strength tests have values less than the specified strength (f'_c).
 - (3) No individual 28-day test shows an average strength less than 90 percent of specified strength (f'_c).
 - c. When tests of control specimens fall below the strength level requirements, the Architect may require core specimens taken from concrete in question and tested in accordance with ASTM C 42. If these specimens do not meet the strength requirements, the Architect will have the right to require additional curing, load tests, strengthening or removal and replacement of those parts of the structure which are unacceptable, and in addition, removal of such sound portions of structure as necessary to ensure safety, appearance and durability of the structure. Additional testing, load tests, strengthening or removal and replacement of parts of the structure and any costs associated with redesign or delay of the project shall be at the Contractor's expense.
 - d. Upon completion of concrete testing for the project the testing agency shall compile all results and perform a statistical strength analysis for each class of concrete in accordance with ACI 214.
9. Additional testing required because of changes in materials, sources of materials or mix proportions requested by the Contractor, and/or extra testing of concrete or materials due to failure to meet the Specification requirements is to be paid by the Contractor.
10. The Contractor shall accept as final, results of tests made by Testing Agency.
11. A final letter shall be issued by the Testing Agency following the completion of work in this Section stating that all testing and inspections for cast-in-place concrete work required by the Statement of Special Inspections have been completed and all identified deficiencies have been corrected.

1.07 NOTIFICATION OF RELATED TRADES

- A. Notify all other trades responsible for installing chases, inserts, sleeves, anchors, louvers, and at other similar locations, when ready for such installation, and for final checking immediately before concrete is placed. Cooperate with such trades to obtain proper installation.
- B. Leave openings in walls for pipes, ducts, and similar penetrations for mechanical and

electrical work, as shown on Drawings or required by layout of mechanical systems.

1.08 SUBSTITUTIONS

- A. Substitutions or any modifications of details proposed by Contractor will be considered by Architect only under the following conditions:
1. Request for substitution or modification has been made and accepted prior to submission of Shop Drawings.
 2. The substitution or modification shall result in a substantial cost and/or schedule advantage to the project.
 3. Sufficient sketches, engineering calculations (prepared by a registered Structural Engineer in the state of the project), and other data have been submitted to facilitate evaluation by the Architect, including cost and/or schedule reduction.
 4. Costs incurred by the Design Team in reviewing substitution requests shall be reimbursed by the Contractor.
 5. Substitutions or other changes to the work proposed by the Contractor shall not be allowed if such changes substantially compromise the stated sustainable design intent.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Cement and Cement Substitutes:
1. Portland Cement - ASTM C 150, Type I or II. Cement for exposed Architectural Concrete shall be specifically selected for "warm light" color as approved by the Architect and shall come from a single source.
 2. Fly Ash – ASTM C 618 Class F.
 3. Ground Granulated Blast-Furnace Slag – ASTM C 989 – Grade 100 or 120.
 4. Blended Cement – ASTM C595, Type IP, IL or IS.
 5. Silica Fume: ASTM C1240.
 6. Ground Glass Pozzolan: ASTM C1866.
- B. Natural Aggregate:
1. Coarse Aggregate: Shall be hard, durable, uncoated crushed stone or gravel conforming to ASTM C 33. Typical coarse aggregate shall pass through a 3/4" sieve and meet the grading requirements of ASTM C 33 size number 67. Coarse aggregate for toppings less than 3" thick, including stair treads/landings, or areas with congested, closely spaced rebar shall pass through a 3/8" sieve and meet the grading requirements of ASTM C 33 size number 8. Coarse aggregate for exposed Architectural concrete shall be specially selected for light color as approved by the Architect and shall come from a single source. Stockpile sufficient quantities to assure continuous supply. Coarse aggregate shall meet the following additional requirements:

Fineness Modulus:	6.70 +/- 0.20 (ASTM C33 size 67 aggregate)
	5.5 +/- 0.20 (ASTM C33 size 8 aggregate)
Organic:	Plate 1 maximum.
Silt:	1.0 % maximum
Soundness:	5% - 8% maximum loss, magnesium sulfate, five cycles.
 2. Fine Aggregate: Shall be sand, clean, hard, durable, uncoated grains, free from silt, loam and clay, to meet ASTM C 33. Fine aggregate for exposed, Architectural

concrete shall be specially selected for light color as approved by the Architect, and shall come from a single source. Stockpile adequate amounts of fine aggregate to assure continuous supply. Fine aggregate shall meet the following additional requirements:

<u>Sieve</u>	<u>Retained Percent</u>
#4	0-5
#16	25-40
#50	70-87
#100	93-97
Fineness Modulus:	2.8 (+/- 0.20)
Organic:	Plate 2 maximum
Silt:	2.0% maximum
Soundness:	5% - 10% maximum loss, magnesium sulfate, five cycles.

- C. Water:
1. Water shall be from the local municipal supply.
- D. Admixtures:
1. Water-reducing Agent shall conform to ASTM C 494, Type A. Water-reducing agent shall be compatible with air-entraining admixture.
 2. Superplasticizer shall conform to ASTM C494, Type F or Type G. Superplasticizer shall be compatible with the other admixtures.
 3. Air-entraining agent shall conform to ASTM C 260.
 4. Calcium Chloride or admixtures containing more than 0.1% Chloride ions are not permitted.
 5. Calcium nitrate corrosion inhibiting admixture shall conform to ASTM C1582 and shall be DCI by GCP Applied Technologies, Eucon CIA by Euclid Chemical, Sika CNI by Sika USA, or an equal approved by the Architect.
 6. Additional admixtures will be considered by the Architect provided they are submitted in accordance with Section 013300 – SUBMITTAL PROCEDURES.
- E. Concrete Reinforcement:
1. Reinforcing steel shall conform to ASTM A 615 deformed bars, Grade 60. Reinforcing to be welded shall conform to ASTM A 706 deformed bars, Grade 60.
 2. Reinforcing bar couplers, mechanical splices and terminators shall conform to ACI 318 to develop at least 125% of the bar yield strength, as manufactured by Lenton, Dayton Superior, BarSplice Products, or equal approved by Architect. Weldable threaded reinforcing couplers shall have a chamfered end to facilitate welding to structural steel pieces.
 3. Welded wire fabric shall conform to ASTM A 1064 in flat sheets.
 4. Supports, metal accessories and other devices necessary for proper installation of concrete reinforcing shall be standardized factory-made wire bar type. Reinforcing supports for slabs on grade shall have continuous integral bearing plates. Concrete bricks and plastic accessories shall not be used. All reinforcing supports shall conform to CRSI RB4.1 "Supports for Reinforcement Used in Concrete" standard. Wire for tying shall be ASTM A1064, 18 gauge black annealed wire.
 5. Accessories touching formed surfaces exposed to view shall have not less than 1/4 inch of high density polyethylene between metal and concrete surface. Plastic tips shall extend not less than 1/2 inch up on metal legs.
- F. Bonding agent for bonding new concrete to existing concrete at construction joints

shall be "Sikadur 32 Hi-Mod" by Sika Corporation; "Dural 452 Gel" by Euclid Chemical Co.; "Deck-O-Weld" by W.R. Meadows or equal approved by the Architect.

G. Concrete Underlayment:

1. For areas to be covered by a finish or flooring:

Self-leveling concrete underlayment used for floor leveling shall be "Sika Level-225" by Sika Corporation, "Ardex K 15" by Ardex, Inc., "EZ Level" by H. B. Fuller Construction Products, Inc., or equal approved by the Architect.

2. For areas to remain exposed:

Self-leveling concrete underlayment used for floor leveling shall be "Sika Level-225" by Sika Corporation, "Ardex SD-T" by Ardex, Inc., "EZ Level" by H. B. Fuller Construction Products, Inc., or equal approved by the Architect.

3. When underlayment is installed to a thickness where aggregate is recommended by the manufacturer, aggregate shall be well-graded, washed fine gravel (1/8 inch to 1/4 inch or larger).

4. For feather finish areas:

Trowelable, cement-based compound to be used at localized depressions in slabs shall be "Sika Level SkimCoat" by Sika Corporation, "Ardex SD-XF" by Ardex, Inc., "TEK Feather Edge Skim Coat" by H.B. Fuller Construction Products, Inc., or equal approved by the Architect.

5. Gypsum based underlayment products are not allowed.

H. Surface Conditioners:

1. Floor hardener for exposed concrete floors shall be "UltraSil LI+ by Euclid Chemical Company, Inc., "L&M Lion Hard" by Laticrete International, Inc., "Liqui - Hard Ultra" by W.R. Meadows, or equal approved by the Architect.

2. Unless otherwise specified, floor hardener is required for all exposed concrete floors. Refer to Architectural Drawings for locations.

I. Other Materials:

1. Joint fillers:

a. Where used with caulking or sealants (joints to remain exposed in finished work), shall be cork type, non-extruding, self-expanding filler strips conforming to ASTM D1752, Type III with removable top snap-caps to allow room for sealants or caulking.

b. Where no sealant or caulking is required, strips shall be closed cell flexible polyolefin type conforming to ASTM D4819, Type II.

c. Joint fillers for exterior paving shall be non-extruding bituminous fiber type in accordance with ASTM D1751 with removable top snap-caps to allow room for sealants.

2. Flexible epoxy joint sealant shall be "Sikadur 51 SL" by Sika Corporation, "Rezi-Weld Flex" by W.R. Meadows, "Dura 340 SL" by Euclid Chemical Company, "Joint Tite 750" by L&M Construction Chemicals or an approved equal. Sealant shall be applied at exposed, non-polished concrete slab on grade locations only. Joint sealant for other control joints in areas to receive flooring shall be provided and installed by the flooring Contractor.

3. Below-Grade Vapor Retarder: See Section 07 26 16.

4. Underslab Insulation: See Section 07 21 00.

5. Curing cover sheets shall be "Hydracure" by PNA Construction Technologies, "Transguard 4000" by Reef Industries, "UltraCure DOT" by Sika Group or equal approved by the Architect.

2.02 CONCRETE MIXES

- A. Provide concrete with the following specified minimum compressive strengths (f'_c) as noted on the drawings and specified below:
 - 1. Slabs on grade: $f'_c = 4,000$ psi
- B. Fly ash, slag, and/or ground glass pozzolan shall be used as a partial replacement for Portland Cement in all concrete mixes for the building and site. The Global Warming Potential (GWP) for concrete mix designs shall be a minimum of 15% lower than industry benchmark concrete mixes for the region as defined by the National Ready Mixed Concrete Association's (NRMCA) report titled "A Cradle-to-Gate Life Cycle Assessment of Ready-Mixed Concrete Manufactured by NRMCA Members – Version 3.2". The report provides benchmark Life Cycle Assessment (LCA) data, including GWP values, for three ready mixed concrete products in eight regions. The following lists the three ready mixed concrete products (28-day compressive strength) and their associated GWP benchmark values for the eastern region:
 - 1. $f'_c = 4,000$ psi GWP = 240.22 kg CO₂e/yd³
- C. Cementitious Materials: Limit percentage, by weight, of substitutes for Portland cement in mixes for concrete assigned to Exposure Class F3 as follows:
 - 1. Fly ash or other pozzolans: 25 percent by mass
 - 2. Slag cement: 50 percent by mass
 - 3. Total of fly ash or natural pozzolans: 35 percent by mass
 - 4. Total of fly ash or natural pozzolans, slag cement: 50 percent by mass
- D. All concrete shall be proportioned in accordance with ACI 211.1 "Selecting Proportions for Normal-Density and High-Density Concrete - Guide" and comply with the requirements of ACI 301 "Specifications for Concrete Construction" Section 4 (trial mixtures or field strength test records).
- E. All concrete with a strength of 4,000 psi or higher shall have a minimum coarse aggregate content of 1,600 lbs/cu.yd.
- F. Water-reducing admixtures shall be used in strict accordance with the manufacturer's printed instructions. All interior concrete slabs shall have a maximum air content of 3% (non-air entrained). All concrete shall contain a water-reducing admixture. Use a high range water-reducing admixture (superplasticizer) in concrete for slabs on grade.
- G. Slump of concrete shall be 4 inches (+/-1 inch). If a superplasticizer is used, the slump shall be 3 inches (+/-1 inch) prior to adding the superplasticizer and 8 inches (+/-1 inch) after adding the superplasticizer.
- H. Premix admixtures in solution form and dispense as recommended by the manufacturer. Include the water in the solution in the design water content of the mixtures.

2.03 MIXING PROCESS

- A. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C94 "Specification for Ready-Mixed Concrete", Option C and ACI 304, "Guide for Measuring, Mixing, Transporting and Placing Concrete".
- B. Concrete delivery tickets shall indicate the amount of water held back at the plant, if applicable.

PART 3 - EXECUTION

3.01 STORAGE

- A. All materials shall be stored to prevent damage from the elements and other causes.
- B. Cement and aggregates shall be stored in such a manner as to prevent deterioration

or intrusion of foreign matter. Any materials which have deteriorated, or which have been damaged, shall not be used for concrete.

- C. Store reinforcing steel on wood skids to protect it from earth and damage from trucking or other construction operations. Reinforcement shall be free from loose mill scale, rust, release agent, concrete splatter and other extraneous coatings at the time it is embedded in the concrete.
- D. Materials which are judged not acceptable for this project shall not be stored on the site but shall be immediately removed from the site.

3.02 VAPOR RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. See Section 07 26 16.

3.03 RIGID INSULATION

- A. Place rigid insulation boards beneath slabs-on-grade, where shown on the Drawings.
- B. Butt edges and ends tight to adjacent boards. Bevel insulation to allow snug fit at cants.
- C. See Section 07 21 00.

3.04 REINFORCING

- A. All reinforcing and accessories shall be placed in accordance with CRSI "Placing Reinforcing Bars" and RB4.1 "Supports for Reinforcement Used in Concrete" publications.
- B. Reinforcing shall be securely tied and supported to maintain proper spacing and cover during placing operations. In no case shall ends of tie wires project towards or touch formwork.
- C. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets one and one-half squares. Stagger sheets to prevent continuous laps in two directions and to limit the number of overlapping layers at lap joints. Secure overlaps with wire ties.
- D. Do not "wet-stick" reinforcing into wet concrete.
- E. Reinforcing shall be free of excessive rust, scale or other coatings that will reduce bond.
- F. Splices: Lap splices as indicated on the Drawings.
 - 1. Bars indicated to be continuous, and all vertical bars shall be lapped a minimum of 40 bar diameters and not less than the values indicated on the Contract Documents.
 - 2. Stagger splices in accordance with ACI 318.
 - 3. Install mechanical splice couplers in accordance with the manufacturer's instructions.
 - 4. Weld reinforcing bars in accordance with AWS D1.4 "Structural Welding Code – Reinforcing Steel".

3.05 EMBEDDED ITEMS

- A. Coordinate the installation of all embedded items required by other trades. Such items normally are to be in place prior to the placing of reinforcing steel.
- B. Place all sleeves, inserts, and other embedded items and secure properly. All embedded items shall be accurately located in plan and to the required elevations. Comply with the tolerances specified in Chapter 7 of AISC 303 "Code of Standard Practice for Steel Buildings and Bridges".

- C. Pipes and conduits by M.E.P. Contractors:
 - 1. Install steel pipe sleeves for all pipes passing through concrete elements.
 - 2. Electrical conduit shall not be placed in concrete slabs on grade.

3.06 PLACING

- A. Notify the Architect and Structural Engineer at least 72 hours prior to each placement.
- B. Do not place concrete until soil bearing material, reinforcing steel, inserts, sleeves and other work to be built into the concrete have been inspected by the Testing Agency for compliance with the approved Shop Drawings and submittals and approved by the Architect and all trades concerned.
- C. Conveying - Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent separation or loss of ingredients and in a manner which will assure that the required quality of the concrete is retained.
- D. Depositing - Delivery and placement of concrete shall be programmed so that the time lapse between batching and placement shall not exceed 1-1/2 hours. Concrete shall not be allowed a free fall of over 4 feet. Concrete shall be deposited as nearly as practicable in its final position, to avoid segregation due to rehandling or flowing.
- E. Concrete shall be deposited continuously such that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. Placing shall be carried out at such a rate that the concrete which is being integrated with fresh concrete is still plastic. Concrete which has partially hardened or has been contaminated by foreign materials shall not be deposited.
- F. Concrete shall be consolidated with the aid of mechanical vibrators in conformance with ACI 309 "Guide for Consolidation of Concrete" to produce a dense, homogeneous mass without voids or pockets. Vibrators should be placed in concrete rapidly so as to penetrate the entire previous lift, to blend the two layers. Vibrating techniques must assure that when the coarse aggregate reaches the form, it stops and the matrix fills the voids.
- G. Concrete placed at horizontal construction joints, including those for toppings, shall be mechanically roughened, cleaned thoroughly of all foreign materials and laitance, and treated with an approved bonding agent. Roughen with suitable tools such as chipping hammers or wire brushes and clean by stream of water or compressed air. Apply approved bonding agent in accordance with the manufacturer's recommendations.

3.07 FLOOR AND OTHER FLATWORK FINISHES

- A. Concrete for finish floor slabs shall be poured as dry as practicable within allowable slump range. Except when otherwise indicated or specified, concrete floor slabs shall be monolithically finished at required elevation by screeding, floating, and troweling (if required) to provide a smooth, even, non-porous finish, free of finishing marks. Do not begin finish troweling until concrete has hardened sufficiently to prevent excess fines from working to the surface. Finish requirements for formed concrete slabs, concrete slabs on deck and concrete slabs on grade are as follows (but must be coordinated with the requirements of the selected flooring manufacturers and contractors which shall govern, if different):
 - 1. *Float Finish:* Slabs to receive unbonded toppings, steel trowel finish, mortar setting beds, equipment pads, and other similar surfaces shall be floated to a smooth, dense, uniform, sandy textured finish. During floating, while surface is still soft, check surface flatness using a 10 foot highway straight edge. Correct high spots by cutting down and correct low spots by filling with material of the same composition as floor finish.
 - 2. *Light Steel Trowel Finish:* At areas to receive resilient floor covering, carpeting, or

other floor covering, perform a light steel troweling immediately after floating. These areas shall be prepared in accordance with ASTM F 710: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

3. *Steel Trowel Finish:* At floors to remain exposed to view, steel trowel immediately after floating. After initial troweling is complete and slabs have set sufficiently to ring the trowel, the surfaces shall be given a second steel troweling to a burnished finish.
 4. *Scratch Finish:* At areas to receive a bonded, applied cementitious application, finish base slab as indicated above, except bull floats or darbys may be used (no troweling). Thoroughly coarse wire broom within two hours after placing to roughen slab surface to ensure a permanent bond between base slab and applied cementitious materials.
 5. *Broom Finish:* Provide edged and jointed broom finish for exposed concrete pavements, loading dock, ramps, stairs, and other similar surfaces. Slab surfaces shall be float finished following the procedures listed below. Following the float finish, use a moistened, stiff bristled natural fiber broom with a long handle to obtain a heavy brush texture finish. Install brush marks perpendicular to the flow of traffic. Repeat edging and jointing operations as required to obtain a distinct edge. Match texture approved by Architect from sample panel.
- B. Concrete floor slabs shall conform to the following flatness and levelness tolerances per ASTM E1155 for Specified Overall Values (SOV) and Minimum Local Values (MLV):

Carpeted areas:

Floor Flatness Number F_F : Specified Overall Value (SOV) = 25
Minimum Local Value (MLV) = 17

Floor Levelness Number F_L : Specified Overall Value (SOV) = 20
Minimum Local Value (MLV) = 15

Exposed areas or areas to receive wood flooring, resilient flooring, or thin set tile:

Floor Flatness Number F_F : Specified Overall Value (SOV) = 35
Minimum Local Value (MLV) = 25

Floor Levelness Number F_L : Specified Overall Value (SOV) = 20
Minimum Local Value (MLV) = 15

Measurements shall be taken by the Testing Agency in accordance with ASTM E1155. Measurements shall be taken the day of the concrete placement but no later than 48 hours afterwards to verify compliance with FF and FL requirements.

Note: Both F_F and F_L numbers are applicable to slabs on grade.

- C. Leveling of the slab by the Contractor to the required tolerances, if not achieved by initial finishing, shall be by machine grinding or by cementitious leveling compound, or both, as approved by the Architect.
- D. Slab Elevation Tolerance: The top surface elevation of slabs on grade must not vary from the specified design elevation by more than +1/4" and -1/2" inch (3/4" inch envelope), as measured at 80% of all points.
- E. Concrete slab surfaces shall be sloped uniformly to drains where noted on the

Drawings.

- F. No dry cement or mixture of sand and cement shall be applied to surface of any concrete slab to absorb moisture.

3.08 FLOOR LEVELING

- A. If determined necessary to meet required elevation tolerances, place self-leveling cementitious underlayment or trowelable cementitious compound for floor leveling in accordance with manufacturer's recommendations:
 - 1. Remove all dirt, grease, sealers, and other foreign materials from existing slab by sandblasting or power washing.
 - 2. Prime and seal entire surface to receive topping. Use bonding agent, applied in strict conformance with manufacturer's instructions.
 - 3. Pour or pump, mixed rough course of underlayment material onto primed area in accordance with manufacturer's instructions, filling areas to within 3/4 inch of the required finish elevation at mid-bay. This rough course shall consist of the underlayment material, mixed with fine gravel aggregate (3/8" maximum size), as applicable and as required by manufacturer.
 - 4. Protect newly applied underlayment from premature surface drying and moisture loss.

3.09 CURING AND PROTECTION

- A. Protect newly placed concrete against low and high temperature effects and against rapid loss of moisture. Cure all concrete for at least seven (7) days at a temperature of at least 50 degrees F by curing methods approved by the Architect. Curing compounds shall not be used.
- B. Protect slabs from damage until completion of job. Slabs to remain exposed or to be polished shall be protected with Masonite or plywood to prevent staining and/or physical damage to slabs. No permanent marks (such as paint, marker and/or pencil) shall be applied to those concrete slabs to be polished, before or after polishing work has been done. No marks shall be made that will be exposed to view in the finished work.
- C. Floor surfaces, after hardening sufficiently to prevent damage, and normally within several hours after final troweling, shall be covered with the approved curing cover sheets with taped, lapped seams.

3.10 FLOOR HARDENING

- A. All interior concrete floors remaining exposed in the finished work shall be treated with a chemical hardener in a three-coat application, not sooner than 28 days after pouring of slab, in accordance with manufacturer's specifications.

END OF SECTION 03 30 00

SECTION 03 54 00
CAST UNDERLAYMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Liquid-applied self-leveling floor underlayment for miscellaneous floor patching.

1.02 RELATED REQUIREMENTS

- A. Section 01 40 00 – Quality Requirements.
- B. Section 09 05 61 – Common Work Results for Flooring Preparation.
- C. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.03 REFERENCE STANDARDS

- A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2021.
- B. ASTM C348 - Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars; 2021.
- C. ASTM C1708 - Standard Test Methods for Self-Leveling Mortars Containing Hydraulic Cements; 2012.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023b.

1.04 REGULATORY REQUIREMENTS

- A. All products and materials must be approved for sale in and meet local, State, and Federal regulations.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data sheets documenting physical characteristics and product limitations of underlayment materials. Include information on surface preparation, environmental limitations, and installation instructions.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.

1.06 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the work of this section with minimum five years of experience and approved by the manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Keep dry and protect from direct sun exposure, freezing, and ambient temperature greater than 105 degrees F.

1.08 FIELD CONDITIONS

- A. Do not install underlayment until floor penetrations and peripheral work are complete.
- B. Maintain minimum ambient temperatures of 50 degrees F 24 hours before, during and 72 hours after installation of underlayment.
- C. During the curing process, ventilate spaces to remove excess moisture.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Cementitious Underlayment: Blended cement mix, that when mixed with water in accordance with manufacturer's directions will produce self-leveling underlayment for use under finish flooring.
 - 1. Compressive Strength, ASTM C1708, C109: Minimum 5000 psi after 28 days.
 - 2. Flexural Strength, ASTM C1708, C348: Minimum 900 psi after 28 days.
 - 3. Tensile Bond Strength, ASTM C1583: 300 PSI
 - 4. Density: 125 lb/cu ft, nominal.
 - 5. Final Set Time: 1-1/2 to 3 hours, maximum.
 - 6. Thickness: Capable of thicknesses from feather edge to maximum 3-1/2 inch.
 - 7. Surface Burning Characteristics, ASTM E84: Flame Spread Index 0, Smoke Developed Index 0.
 - 8. Products:
 - a. Ardex Engineered Cements; K15.
 - b. Uzin; NC 172 Turbo.
 - c. Maxxon; Level-Right.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Water: Potable and not detrimental to underlayment mix materials.
- C. Primer: Manufacturer's recommended type.
- D. Joint and Crack Filler: Latex based filler, as recommended by manufacturer.

2.02 MIXING

- A. Site mix materials in accordance with manufacturer's instructions.
- B. Mix to self-leveling consistency without over-watering.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that underlayment is compatible with scheduled floor covering and adhesives.
- B. Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate. Do not use acid or mastic removers on any surface. Surfaces shall be 50 degrees F, minimum and 90 degrees F maximum.
- C. Coordinate with the requirements of Section 09 05 61 – Common Work Results for Flooring Preparation, slab flatness investigation, slab moisture testing and any slab moisture remediation required.

3.02 CEMENTITIOUS UNDERLAYMENT PREPARATION

- A. Concrete: Mechanically prepare steel troweled concrete to create a textured surface necessary to achieve the best bond; acceptable methods include bead blasting and scarifying. Do not use acid etching.
- B. Remove substrate surface irregularities. Fill voids and deck joints with filler. Finish smooth.
- C. Vacuum clean surfaces.
- D. Close floor openings.

3.03 APPLICATION

- A. Install products in accordance with manufacturer's instructions.
- B. Pump or pour material onto substrate. Do not retemper or add water.
 - 1. Pump, move, and screed while the material is still highly flowable.
 - 2. Be careful not to create cold joints.
 - 3. Wear spiked shoes while working in the wet material to avoid leaving marks.

- C. Place to indicated floor elevation, achieving a minimum 1/8 inch thickness, with top surface level to 1/8 inch in 10 ft.
- D. If a fine, feathered edge is desired, steel trowel the edge after initial set, but before it is completely hard.
- E. For subfloor surfaces intended to slope to floor drains, build-up product shall be installed precisely to create proper pitch. Floor pitch shall be laser verified with results submitted to the Architect and Owner.

3.04 CURING

- A. Once underlayment starts to set, prohibit foot traffic until final set has been reached.
- B. Air cure in accordance with manufacturer's instructions.

3.05 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field inspection and testing, as specified in Section 01 40 00 - Quality Requirements.
- B. Placed Material: Agency will inspect and test for conformance to specification requirements.

3.06 PROTECTION

- A. Protect against direct sunlight, heat, and wind; prevent rapid drying to avoid shrinkage and cracking.
- B. Do not permit traffic over unprotected floor underlayment surfaces.

END OF SECTION

SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 – GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this section.
- C. Coordinate work with that of all other trades affecting or affected by work of this Section. Coordinate with such trades to assure the steady progress of all work under the Contract.

1.02 SECTION INCLUDES

- A. The work of this Section consists of furnishing and erecting all structural steel work as shown on the Drawings and as specified herein and includes, but is not limited to, the following:
 - 1. Beams with connections.
 - 2. Channels, angles, plates, frames, anchors, and other similar pieces.
 - 3. Shop paint and field touch-up paint after erection.

1.03 RELATED SECTIONS

- A. Related work shall be performed under the following Sections:
 - 1. Section 05 50 00 METAL FABRICATIONS.
 - 2. Section 07 81 00 APPLIED FIREPROOFING.
 - 3. Section 09 90 00 PAINTING AND COATING.

1.04 CODES AND REFERENCES

- A. All work in this Section shall conform to the requirements of the Maine Uniform Building and Energy Code including, but not limited to, the References listed below:
 - 1. American Institute of Steel Construction (AISC):
AISC 303 "Code of Standard Practice for Steel Buildings and Bridges",
AISC 360 "Specification for Structural Steel Buildings",
AISC 341 "Seismic Provisions for Structural Steel Buildings", and
"Steel Construction Manual"
 - 2. Research Council on Structural connections (RCSC): "Specification for Structural Joints Using High-Strength Bolts".
 - 3. American Welding Society (AWS): AWS D1.1 "Structural Welding Code - Steel".
 - 4. American Society for Testing and Materials (ASTM): standards listed within.
 - 5. Steel Structures Painting Council (SSPC): standards listed within.
- B. In case of conflict between the References and the Project Specification, or in the case of conflict between References, the more stringent shall govern.
- C. When compliance with any such References is specified herein for materials or a manufactured or fabricated product, the Contractor shall furnish an affidavit from the manufacturer or fabricator certifying that the materials or product delivered to the job meets the requirements specified. However, such certification shall not relieve the Contractor from the responsibility of complying with any added requirements specified herein.

1.05 SHOP DRAWINGS AND SUBMITTALS

- A. Submit complete Shop Drawings and other submittals in accordance with the provisions of Section 01 30 00 – SUBMITTAL PROCEDURES.
- B. Prior to preparation of Shop Drawings, the Contractor shall verify all dimensions, site conditions, and other similar pertinent information relating to existing conditions. Any discrepancies which affect the structural design or details shall be brought to the attention of the Architect and Structural Engineer.
- C. Shop Drawing Requirements:
 - 1. Shop Drawings shall include all information required for fabrication of the component parts of the structure. They shall indicate size, weight, surface preparation, and protective coatings of components, type and location of shop and field connections, and type, size and extent of all welds. The welding symbols used on the Shop Drawings shall be as adopted by the American Welding Society. Identify type, size, finish, and length of bolts, distinguishing between shop and field bolts.
 - 2. Approval of Shop Drawings shall be for size and arrangement of primary and auxiliary members and for general conformance with the requirements of the Contract Documents. Any errors, omissions, or incorrect dimensions shown on the Shop Drawings shall be the responsibility of the Contractor. Corrections, modifications, or comments made by the Architect or Structural Engineer to connections and details during the shop drawing approval process shall not be cause for schedule delay or additional cost to the Owner. The Contractor is responsible for furnishing and installing all materials called for in the Contract Documents. Review of the Shop Drawings by the Architect shall not relieve the Contractor of this responsibility.
 - 3. Where resubmission of Shop Drawings has been requested by the Design Team, or where additions or corrections to previously approved Shop Drawings have been made by the fabricator, all revisions shall be clouded or otherwise identified. Resubmittal packages that include revised Shop Drawings with revisions not clearly identified or previously approved Shop Drawings that have not been revised are subject to return without review.
 - 4. Fabrication of any material or performing of any work prior to the final approval of the Shop Drawings shall be entirely at the risk of the Contractor.
- D. Other Submittals
 - 1. Provide Manufacturer's data for structural steel primers to be used.
 - 2. Submit welding certificates for all individuals performing shop or field welding on the project.
 - 3. Prior to commencing installation of materials required hereunder, furnish the Architect with certification that requirements pertaining to shop painting have been performed in the manner specified.
 - 4. Reports: Submit certified copies of mill test reports for all structural steel furnished.
- E. Reproduction of structural plans, sections and details, and any like information by reprographic or electronic methods for use as Shop and Coordination Drawings is subject to the requirements of Section 01 14 01 – ELECTRONIC RELEASE FORM. Reproduction of structural plans, sections and details, and any like information by reprographic or electronic methods for use as Shop and Coordination Drawings is subject to the following conditions:
 - 1. The entity producing the Shop and Coordination Drawings (The "User") agrees to accept the reproduced information from Foley Buhl Roberts & Associates, Inc. without any warranties, guarantees and/or representations of any nature

whatsoever regarding the correctness, dimensional and/or quantitative accuracy and/or completeness of any such information contained therein.

2. The User further agrees that such information shall be used as reference material only for the production of Shop and Coordination Drawings for the referenced project to which this Specification applies and only for that project.
3. The User further agrees to release, indemnify, hold harmless and defend Foley Buhl Roberts & Associates, Inc. with respect to any claims, costs (including the cost of litigation), losses, damages and/or liabilities which arise from (or relate to) the use, misuse, modification, interpretation, misinterpretation and/or misrepresentation of the reproduced information.

1.06 QUALITY ASSURANCE

- A. Qualifications: The steel fabricator and erector conducting the work of this Section shall be AISC certified and experienced in fabricating and erecting structural steel of scale and complexity similar to this project.
- B. Testing and Inspections: All structural steel framing, materials, accessories, and workmanship under this Section shall be subject to inspection in the mill, shop or field by the Architect, and/or by the Owner's Testing Agency.
 1. A qualified Testing Agency for testing and inspection will be selected by the Owner and shall be paid directly by the Owner.
 2. However, such inspection, wherever conducted, shall not relieve Contractor of his responsibility to furnish materials and workmanship in accordance with Contract requirements, nor shall inspector's acceptance of materials or workmanship prevent later rejection of same by the Owner or Architect if defects are discovered.
 3. The Contractor shall give proper notice to the Testing Agency and shall make necessary accommodations and provide access for the Testing Agency to conduct the testing and inspection work required by the Statement of Special Inspections.
 4. Inspection of welding for work for beam splices shall be tested one hundred (100) percent either by ultrasonic or by radiography in accordance with the latest edition of the AWS D1.1.
 5. Inspection of welding work other than beam splices and moment connections shall consist of non-destructive spot testing done by visual, magnetic particle, radiographic or ultrasonic methods, whichever is most effective for joint to be tested.
 6. Inspection of bolting work shall be in accordance with RCSC "Specification for Structural Joints Using High-Strength Bolts". All bearing (Type N) bolts shall be fully tightened. Slip critical (Type SC) bolts shall be fully tensioned.
 7. A final letter shall be issued by the Testing Agency following the completion of work in this Section stating that all testing and inspections for structural steel work required by the Statement of Special Inspections have been completed and all identified deficiencies have been corrected.

1.07 SUBSTITUTIONS

- A. Substitutions or any modifications of details proposed by Contractor will be considered by Architect only under the following conditions:
 1. Request for substitution or modification has been made and accepted prior to submission of Shop Drawings.
 2. The submission or modification shall result in a substantial cost and/or schedule advantage to the project.
 3. Sufficient sketches, engineering calculations (prepared by a registered Structural Engineer), and other data have been submitted to facilitate evaluation by the Architect, including cost and/or schedule reduction.

4. Costs incurred by the Design Team in reviewing substitution requests shall be reimbursed by the Contractor.
5. Substitutions or other changes to the work proposed by the Contractor shall not be allowed if such changes substantially compromise the stated sustainable design intent.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Structural steel shall comply with the requirements of the following:
 1. W, WT, C and MC shapes: ASTM A992 (50 ksi minimum yield).
 2. All other structural shapes: ASTM A572 (50 ksi minimum yield).
 3. Square, rectangular and round HSS: ASTM A500 – Grade C (50 ksi minimum yield).
 4. Structural Steel Pipe: ASTM A53 – Grade B (35 ksi minimum yield).
 5. Structural Steel Plates and Bars: ASTM A572 (50 ksi minimum yield).
- B. Bolts, nuts and washers shall comply with the requirements of ASTM F3125. Bolts shall be F3125 Type N with washer; except F3125, Type SC at slip-critical connections indicated on the drawings.
- C. Expansion bolts shall be “Kwik Bolt TZ2” by Hilti, “Strong-Bolt” by Simpson Strong-Tie, “Power-Stud+SD2” by Dewalt, or an approved equal.
- D. Adhesive anchors shall be threaded rods complying with the requirements of ASTM F1554 - Grade 36. Adhesive anchoring system shall be “HIT-HY 100” by Hilti, “Set-3G” by Simpson Strong Tie, “AC200+” by Dewalt, or an approved equal. Use renovation screens when bolting to hollow substrate.
- E. Metallic Filler: Composition of 90% ground metal and 10% epoxy binder such as “Devcon Plastic Steel Putty” by ITW Performance Polymers, “Scotch-Weld Epoxy Adhesive 1751” by the 3M Corporation, “PC3965” by Loctite, or an approved equal.
- F. Plastic washers and shims shall be Korolath Shim, Dynamex Shim Spacer, Deslauriers Versa-Shim, or equal approved by the Architect.

2.02 FABRICATION

- A. All structural steel shall be fabricated in accordance with the References, approved Shop Drawings, and as hereinafter specified.
- B. Weld and joint details shall comply with requirements of AWS D1.1. Welding, as indicated on the Drawings, shall be in accordance with References and shall be done only by experienced welders who have been qualified by tests as prescribed in AWS D1.1 for the type of work required.
- C. All shop connections shall be welded or bolted.
- D. Bolting shall comply with the requirements of RCSC "Specification for Structural Joints Using High-Strength Bolts".
- E. All field connections shall be bolted, except where welding is indicated on the Drawings.
- F. Diameter of holes in bolted parts shall be 1/16" greater than the nominal diameter of the bolt. No unfair holes will be accepted, and enlargement of holes shall not be accomplished by burning. Burrs resulting from drilling or punching shall be ground to the surface of the material. Shearing and punching shall be done cleanly so as not to deform or mar adjacent surfaces.
- G. Provide holes and connections as required for site assembly of steel work. Holes shall be drilled, plasma cut or punched and reamed in the shop. Show sizes and locations of all such holes on the Shop Drawings.

- H. Provide angles, channels, and/or other steel as necessary around all openings in the floors and roof at drains, fans, and other similar penetrations in addition to the openings shown on the Drawings.

2.03 SURFACE PREPARATION AND PROTECTIVE COATINGS

- A. All structural steel shall be cleaned of all scale, rust, grease and other foreign matter.
- B. Surface preparation for interior structural steel that will not be exposed to view in the finished work shall be in accordance with "Steel Structures Painting Council Surface Preparation No. 3, Power Tool Cleaning".
- C. Structural steel not exposed to view shall be left unprimed.
- D. Where primer is required on steel members, omit the primer at the following locations:
 - 1. Surfaces to be field-welded.
 - 2. Surfaces at slip-critical connections.
 - 3. The tops of steel beams where deck is to be welded.
 - 4. Surfaces to be spray fireproofed.
- E. Shop and field touch up primers shall be compatible with intumescent paint or paint to be used for finish painting in the field. Coordinate with Section 078100 APPLIED FIREPROOFING and Section 099000 PAINTING AND COATING.
- F. After erection, all scarred areas shall be touched up with the same paint as the shop coat.

PART 3 - EXECUTION

3.01 HANDLING, SHIPPING AND STORAGE

- A. Care and protection shall be given to all structural steel, bolts, and other fasteners during handling, shipping and storage. If items are to be stored prior to installation, they shall not be placed in contact with the ground. Care shall be taken to avoid abrasions and other damage.

3.02 ERECTION

- A. All structural steel shall be anchored and erected in accordance with References, approved Shop Drawings, and as hereinafter specified.
- B. All work shall be accurately set to established lines and elevations and rigidly fastened in place with suitable attachments to the construction of the building.
- C. Temporary bracing, guying, and support shall be provided to keep the structure safe and aligned at all times during construction, and to prevent danger to persons and property. Check all temporary loads and stay within safe capacity of all building components.
- D. Except as otherwise indicated on the Drawings, all field connections shall be bolted in accordance with RCSC "Specifications for Structural Joints using High-Strength Bolts". All bearing (Type N) bolts shall be fully tightened. Slip critical (Type SC) bolts shall be fully tensioned. All field bolts shall be tension control (TC) type, with twist-off splines, conforming with ASTM F1852. All twist-off splines shall be removed. Bolts that are hand tightened shall be clearly marked upon completion. Use not less than one (1) washer placed under the turning part of the assembly. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts. Replace connection plates that are misaligned where holes cannot be aligned to produce acceptable final appearance.
- E. Field welding, as indicated on the Drawings, shall be in accordance with References and shall be done only by experienced welders who have been qualified by tests as prescribed in AWS D1.1 for the type of work required.

- F. All proposed field modifications, repairs, and reinforcement to structural steel framing or connections shall be documented on a revised shop drawing and submitted to the Architect for review. Do not cut or alter any member in the field without Architect's prior written approval for each specific condition.
- G. After erection, all structural steel members and connections shall be touched up with the appropriate primer.
- H. The initial installations of expansion bolts and adhesive anchors shall be witnessed by the manufacturer's representative and load tests shall be performed to test their adequacy.

3.03 TOLERANCES

- A. Individual structural steel members shall be plumbed, leveled, and aligned in accordance with the requirements of Chapter 11 of the AISC 303 "Code of Standard Practice for Steel Buildings and Bridges", except as follows:
 - 1. Unless noted otherwise on the Drawings, combined tolerances (including but not limited to rolling, fabrication, and erection) for any framing member in the completed structure shall result in any point along the member length being located no more than $\frac{3}{4}$ inch from its theoretical plan location.
 - 2. Members at connections to columns shall be within $\frac{1}{8}$ inch vertically of their theoretical elevations.

END OF SECTION 05 12 00

SECTION 05 51 00
METAL STAIRS AND RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Guardrails and handrails.

1.02 RELATED REQUIREMENTS

- A. 01 45 33 – Code-Required Special Inspections and Procedures.
- B. 01 45 33.1 – Statement of Special Inspections: Special inspector scope for this section.
- C.
- D. Section 09 91 23 - Interior Painting: Paint finish.
- E. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures 2006.
- C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- D. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling 2022.
- E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- G. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2023.
- H. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.
- I. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.
- J. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.
- K. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.
- L. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2023.
- M. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings 2021.
- N. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength 2022.
- O. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.
- P. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2023).

- Q. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172 2019.
- R. NAAMM AMP 510 - Metal Stairs Manual.
- S. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product data for all manufactured items.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- D. Shop Drawings: Submit tube and railing shop drawings drawn at not less than 1/4" scale with components shown in related positions. It is expected that final design adjustments will be made as part of this submittal and review process and no claim for additional compensation will be accepted. Provide larger scale custom details. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Show all required field dimensions.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
 - 2. Include the design engineer's stamp or seal on each sheet of shop drawings.
 - 3. Indicate points of support and loads imposed on supporting structure.
 - 4. Shop drawings shall indicate all components, both custom fabricated and manufactured products.
- E. Submit structural analysis and certification sealed and signed by a qualified professional structural engineer, licensed in the State of Maine, that the stairs, and railings comply with the required structural design loads.
- F. Submit fabricator's certification that the stairs, and railings provided are in full compliance with the requirements of the Construction Documents and are totally suitable for the proposed installations when installed in accordance with the Shop Drawings.
- G. Submit evidence of the steel fabricator's in-plant special inspections program including: registration of special inspections program, written procedural and quality control manual and evidence of periodic auditing of fabrication practices by an approved inspection agency.
- H. Welders' Certificates.
- I. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.05 REGULATORY REQUIREMENTS

- A. All products and materials must be approved for sale in and meet local, State, and Federal regulations.

1.06 QUALITY ASSURANCE

- A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.
- B. Welder Qualifications: Show certification of welders employed on the Work, verifying AWS qualification within the previous 12 months.
- C. Fabricator Qualifications: Accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel (AC172) or a member of SSFNE, who participates in a recognized quality assurance program and who is regularly inspected by an independent testing/inspection agency.

- D. In the absence of the above requirements, the fabricator shall be required to hire and pay for an independent testing/inspection agency, approved by the Owner, to monitor fabrication and perform random testing of all stair and railing fabrication procedures, and to report to the Owner
- E. Manufacturers: Companies specializing in manufacturing products specified in this Section, with not less than ten (10) years of documented experience.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle components in such a manner as to prevent damage to finished surfaces. Store components in a dry, clean location, away from uncured masonry and concrete.

1.08 STRUCTURAL REQUIREMENTS

- A. Structural Design: Provide complete railing assemblies complying with applicable codes.
- B. Handrail and Guardrail Assemblies: Comply with ASTM E985, ASTM E894, and withstand the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each component.
 - 1. Handrails shall be rigid, free of vibration and able to withstand a concentrated force of 200 pounds applied at any point in any direction and, but not simultaneously, a uniform load of 50 pounds per foot applied in any direction.
 - 2. Top Guardrail member shall be rigid and able to withstand a concentrated force of 200 pounds applied at any point and in any direction and, but not simultaneously, a uniform load of 100 pounds per foot applied vertically downward to the top of the guard.
 - a. Infill areas of guardrails shall be rigid and able to withstand a horizontal concentrated force of 200 pounds applied on one square foot at any point in the system including panels, intermediate rails, balusters, or other elements. This loading condition shall not be applied simultaneously with the other loading conditions for guardrails.
 - b. Guardrail System shall withstand stresses resulting from railing system loads specified above.

PART 2 PRODUCTS

2.01 METAL RAILINGS - GENERAL

- A. Metal Railings: Provide railings of the design specified, complete with vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
 - 1. Handrails: Comply with applicable accessibility requirements of ADA Standards.
 - 2. Dimensions: As indicated on Drawings.
 - 3. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
 - 4. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
 - 5. Separate dissimilar metals using paint or permanent isolation membrane.
- B. Metal Jointing and Finish Quality Levels:
 - 1. Commercial: Exposed joints as inconspicuous as possible, whether welded or mechanical; underside of stair not covered by soffit IS considered exposed to view.
 - a. Welded Joints: Intermittently welded on back side, filled with body putty, and sanded smooth and flush.
 - b. Welds Exposed to View: Ground smooth and flush.
 - c. Mechanical Joints: Butted tight, flush, and hairline.
 - d. Bolts Exposed to View: Countersunk flat or oval head bolts; no exposed nuts.
 - e. Exposed Edges and Corners: Eased to small uniform radius.
 - f. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for satin or matte finish.
- C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

- D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.02 HANDRAILS AND GUARDRAILS

- A. Steel Wall-Mounted Rails: Round pipe rails unless otherwise indicated.
1. Outside Diameter: 1.66 inch. (actual)
 - a. Finish: Primed for field finishing.
 2. Handrail Brackets:
 - a. Wall Mounted:
 - 1) Carbon steel, 3" round disk for wall mount with single tapped anchor hole, 3-1/4" projection, with 5/8-inch bent bar.
 - 2) Width/Height: As indicated on the drawings.
 - 3) Spacing: As indicated on the Drawings and required to meet engineering.
 - 4) Finish: Primed for field finishing.
 - 5) Product:
 - (a) Wagner Companies, #RB14130.

2.03 MATERIALS

- A. Steel Sections: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A500 or ASTM A501 structural tubing, round and shapes as indicated.
- C. Steel Plates: ASTM A6 or ASTM A283.
- D. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
1. Hot-Rolled Steel Sheet: ASTM A1011, Designation CS (commercial steel).
 2. Cold-Rolled Steel Sheet: ASTM A1008, Designation CS (commercial steel).
- E. Concrete Fill: Type specified in Section 03 30 00.
- F. Concrete Reinforcement: Mesh type as detailed, galvanized.

2.04 ACCESSORIES

- A. Steel Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1.
- B. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- C. Railing Fittings (Steel): Typical fittings shall include # 938 weld on caps, # 665 and # 1665 wall returns, # 386, by Julius Blum and Co. or equivalent.

2.05 SHOP FINISHING

- A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- B. Do not prime surfaces in direct contact with concrete or where field welding is required.
- C. Prime Painting: Primer compatible with finish coating as specified in Section 09 91 23 – Interior Painting.

2.06 RAILING FABRICATION - GENERAL

- A. In general, heights of handrails shall be 34 inches above nosings. Heights of guardrails shall be a minimum of 42 inches above finish floor, unless otherwise noted on the Drawings. Handrails shall be mounted to provide a minimum of 2-1/4 inch clear space to walls and other surfaces.
- B. Space intermediate balusters as indicated on the Drawings or as otherwise required to provide a maximum clear space between all members of less than four (4) inches. Space railing posts as indicated on the Drawings, and in accordance with railing engineering requirements.
- C. In general, handrails at stairs shall extend at least 12 inches beyond the top riser and at least 12 inches plus the width of one tread beyond the bottom riser. At the top, the handrail extension shall be parallel to the walking surface. At the bottom, the handrail shall continue to slope for a

distance of the width of one tread from the bottom riser, with the remainder parallel to the walking surface.

- D. In general, handrails at ramps shall be parallel to the walking surface at all locations and shall extend at least 12 inches beyond the top of the ramp and at least 12 inches beyond the bottom of the ramp.

2.07 FABRICATION - GENERAL

- A. Fit and shop assemble components in largest practical sections, for delivery to site.
- B. Fabricate components with joints tightly fitted and secured.
- C. Railings shall be fabricated such that the triangle formed between the tread, riser and bottom rail shall not allow a 4 inch sphere to pass.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each configuration required. Maintain cylindrical cross section of pipe throughout the entire bend without buckling, twisting, cracking or otherwise deforming.
- F. All exterior railings, fittings and brackets shall be hot-dipped galvanized after fabrication.
- F. Provide expansion joints in railings at intervals not to exceed forty (40) feet. Provide slip joints with internal sleeves extending two (2) inches beyond the joint on either side. Fasten the internal sleeve securely on one side only. Locate expansion joints within six (6) inches of posts.
- G. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- H. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- I. Fabricate components accurately for anchorage to each other and to building structure.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Verify that rough opening and structural support are properly prepared prior to beginning installation.

3.02 PREPARATION

- A. When field welding is required, clean and strip primed steel items to bare metal.
- B. Supply items required to be cast into concrete and embedded in masonry with setting templates.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects.
- C. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.
- D. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- E. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.
- F. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.

- G. Obtain approval prior to site cutting or creating adjustments not scheduled.
- H. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete. All steel to be painted to be properly prepared for primer and primed to accept finish paint.
- I. Where railings are to be set in concrete, railing posts shall be set in six (6) inch matching sleeves. Clean dust and foreign matter from sleeves and moisten interior of hole and surfaces with clean water. Pour fast setting cement into the annular space until it overflows the hole. Taper cement away from rails to promote proper drainage.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.

3.05 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for general requirements for testing and inspections.
- B. General: Stair, landing and railing materials and fabrication procedures are subject to inspection and tests in mill, shop, and field, conducted by a qualified testing agency. Such inspections and tests shall not relieve the Contractor of responsibility for providing his own inspections, quality control and materials and fabrication procedures in compliance with specified requirements. Any non-compliant materials or fabricated components shall be removed and replaced.
- C. The fabricator shall submit evidence of in-plant inspections in conformance with the International Building Code Structural Tests and Inspections - Inspection of Fabricators (1700).
- D. The fabricator's structural engineer shall inspect the stair installation, component type, size, spacing and placement for conformance with the approved stair system design and check member-to-member connections and connections to adjacent steel and concrete support elements, once during performance of the work and once after completion of the work.
- E. Testing and inspection shall be performed by the Owner's Testing Agency and/or Special Inspector as identified in the Statement of Special Inspections.
- F. If Work is found not to conform to the Construction Documents, the Contractor shall be responsible for the cost of all further testing.
- G. The Contractor shall cooperate with and facilitate testing and field inspections. The Contractor shall, at his own expense, furnish the testing agency stair and railing shop drawings. Field bolted and welded connections shall be inspected.

END OF SECTION

SECTION 06 10 54
WOOD BLOCKING AND CURBING

PART 1 GENERAL

1.01 SECTIONS INCLUDES

- A. Preservative-treated wood materials.
- B. Fire-retardant-treated wood materials.
- C. Communications and electrical room mounting boards.
- D. Wood in contact with membrane roofing.
- E. Concealed wood blocking, nailers, and supports for support of wall mounted items furnished by under the contract or by Owner, including, but not limited to: toilet and bath accessories, grab bars, railings, wall cabinets, wood trim, counters, and all other wall mounted fixtures and equipment.
- F. Isolation strips to separate preservative treated wood from metal surfaces.

1.02 RELATED REQUIREMENTS

- A. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.03 REFERENCE STANDARDS

- A. APA E30 - Engineered Wood Construction Guide; 2011.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- C. ASTM D2898 - Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010 (Reapproved 2024).
- D. AWPA M4 - Standard for the Care of Preservative-Treated Wood Products; 2011.
- E. AWPA U1 - Use Category System: User Specification for Treated Wood; 2025.
- F. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. ITS (DIR) - Directory of Listed Products; Current Edition.
- H. PS 1 - Structural Plywood; 2023.
- I. PS 20 - American Softwood Lumber Standard; 2025.
- J. SPIB (GR) - Standard Grading Rules; 2021.
- K. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 REGULATORY REQUIREMENTS

- A. All products and materials must be approved for sale in and meet local, State, and Federal regulations.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data:
 - 1. Fire-retardant treatment.
 - 2. Pressure-preservative treatment.
 - 3. Field-applied preservative treatment product data and application instructions.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- D. Certifications: Submit wood preservative treated manufacturer's certifications that treated materials comply with requirements. Indicate type of preservative used, net amount of

preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing and finishing treated materials.

1. Submit verification of compliant moisture content for waterborne treated products.
 2. Submit warranties from chemical treatment manufacturers for each type of treatment.
- E. Submit dimension lumber certificates indicating compliance with minimum allowable unit stresses. Indicate species and grade selected for each used and design values approved by the American Lumber Standards Committee Board of Review.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Cover wood products to protect against moisture. Support stacked products to prevent deformation and allow air circulation.
- B. Fire-Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

1.07 QUALITY ASSURANCE

- A. Coordination with other Trades and Owner-furnished items: Coordinate the location of blocking, nailers, and similar supports for finish materials, millwork, casework, finish carpentry, equipment, hardware and accessories, regardless of whether such items are Owner or Contractor furnished or Owner or Contractor installed, so that the installation of finish work may be properly executed in compliance with the intended design requirements. Before starting installation of supports, carefully check all related shop drawings and submittals and confirm with Owner full extent of owner provided items, whether Owner installed or Contractor installed.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
1. Species: Spruce-Pine-Fir, unless otherwise indicated.
 2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org), and that provides grading service for species and grade specified. Provide lumber stamped with grade mark unless otherwise indicated.
 3. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

2.02 DIMENSION LUMBER

- A. Sizes: Nominal sizes as indicated on drawings, S4S.
- B. Moisture Content: Kiln-dry or MC15.
- C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
1. Lumber: S4S, No.2 or Standard Grade.
 2. Boards: Standard or No.3.

2.03 CONSTRUCTION PANELS

- A. IT/Electrical Backer Boards: PS 1, A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
1. Product:
 - a. U-teck; Fire Retardant Backerboards.
 - b. Plywood from manufacturers listed for fire retardant treated lumber.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Plywood Concealed from View but Located Within Exterior Enclosure: PS 1, C-C Plugged or better, exterior grade.
- C. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.

2.04 FIRE-RETARDANT TREATMENT (FRT)

- A. Fire Retardant Treatment Manufacturers:
 - 1. Hoover Treated Wood Products.
 - 2. ProWood; UFP Industries, Inc.
 - 3. D-Blaze; Viance Treated Wood.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Factory-treat wood members in accordance with AWP A U1 and use category indicated.
- C. Fire-Retardant Treatment: Interior Type A, Use Category UCFA (LT), Low-Temperature (low hygroscopic).
 - 1. Treat blocking and other wood members concealed in noncombustible construction within the interior building environment.
 - 2. Treat electrical and communications panel backer boards.
- D. Fire-Retardant Treatment: Exterior Type B, Use Category UCFB.
 - 1. Treat blocking and other wood members concealed in noncombustible construction in exterior environments, including, but limited to exterior canopy blocking and plywood sheathing.
 - 2. Treat exterior window bucks and blocking.
- E. Kiln-dry after treatment (KDAT) to maximum moisture content of 19 percent for sawn material and 15 percent for plywood.
- F. Fabrication of FRT Wood:
 - 1. Ripping or milling of boards, lumber, and timber after treatment is not permitted.
 - 2. Field cutting to length and drilling of holes in boards, lumber, and timber are permitted without additional treatment.
 - 3. Field cutting and drilling of holes in plywood are permitted.
- G. Label or brand FRT wood with classification mark of UL (DIR) or ITS (DIR) or other approved inspection agency, the treatment plant, name of treatment, species of wood, flame spread and smoke-developed indexes, method of drying after treatment, and treating standard.
 - 1. In addition, Exterior Type B labeling shall include the words: NO INCREASE IN THE LISTED CLASSIFICATION WHEN SUBJECTED TO THE STANDARD RAIN TEST (ASTM D2898).

2.05 PRESSURE-PRESERVATIVE TREATMENT (PPT)

- A. Factory-treat wood members in accordance with AWP A U1 and use category indicated.
- B. Preservative Limitations for Interior Use Categories UC1 and UC2:
 - 1. Use SBX preservative.
- C. Applications - Treat the Following:
 - 1. Wood framing members in direct contact with interior of exterior masonry or concrete walls below grade: Use Category UC2, above ground, interior, damp..
 - 2. Lumber and plywood in contact with membrane roofing and flashing: Use Category UC3B, above ground, exterior.
 - 3. Lumber and plywood in contact with waterproofing and flashing: Use Category UC4A, ground contact.
- D. Kiln-dry wood after treatment with waterborne preservative to maximum moisture content of 19 percent for lumber and 15 percent for plywood.
- E. Perform fabrication such as cutting, boring, milling, and surfacing to maximum extent practicable before treatment.
- F. Label preservative-treated wood with marking as required by AWP A U1 and ICC (IBC). Unless otherwise permitted by standard U1 and the building code, marking shall include the

phrase: AWP A U1, accredited inspection agency's mark, and shall identify treating plant, type of preservative, retention, and end use.

- G. Field Treatment for Cuts and Holes in Preservative-Treated Wood: Comply with AWP A M4.

2.06 ACCESSORIES

- A. Metal and Finish of Fasteners:
1. Fire-Retardant-Treated Wood:
 - a. Nails, timber rivets, wood screws, and lag screws: Hot-dip galvanized steel complying with ASTM A153/A153M Class D or Type 304 stainless steel.
 2. Preservative-Treated Wood:
 - a. Nails, timber rivets, wood screws, and lag screws - general use: Hot-dip galvanized steel complying with ASTM A153/A153M Class D or Type 304 stainless steel.
 3. Untreated Wood: Hot-dip galvanized steel complying with ASTM A153/A153M Class D.
- B. Isolation Strips: Self-adhering sheet, adhesive capable to adhesion to substrate without the use of a primer, with strippable release paper.
1. Products:
 - a. GCP Applied Technologies; Vycor V40 Tape.
 - b. Carlisle Coatings and Waterproofing, Inc; CCW-705 Strips.
 - c. 3M; 3015NP Tape.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

- A. Coordinate installation of rough carpentry members specified in other sections.
- B. Examine and correct any conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected. Set members level and plumb, in correct position.
- C. Select material sizes to minimize waste.
- D. Reuse scrap to greatest extent possible; clearly separate scrap for use on-site as accessory components, including shims, bracing, and blocking.
- E. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.
- F. Place horizontal members with crown side up.
- G. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.
- H. Coordinate curb installation with installation of decking and support of deck openings.
- I. Provide miscellaneous members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- J. Cut out and discard all defects that will render a piece unable to serve its intended function. The Architect may reject lumber whether or not it has been installed, for excessive checking, warp, twist, bow, crook, mildew, fungus or mold as well as for improper cutting and fitting.
- K. Securely attach rough carpentry work to substrate by anchoring and fastening complying with CABO NER-272 for power-driven fasteners, and fastening schedules in the International Building Code, unless otherwise indicated.
- L. All preservative treated wood shall be separated from all aluminum and steel surfaces by use of flexible membrane isolation strips.

3.02 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim. Blocking shall be minimum 1-1/2" thick materials.

- B. Wedge, anchor and align blocking to provide a rigid and secure installation of both blocking and other work related thereto.
- C. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build anchor bolts into masonry during installation of masonry work wherever possible. Secure anchor bolts to formwork before concrete placement wherever possible.
- D. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- E. All preservative treated wood blocking shall be separated from all metal (coated and uncoated) by use of isolation strips.
- F. Provide the following specific nonstructural framing and blocking, including but limited to the following areas:
 - 1. Cabinets and shelf supports.
 - 2. Wall brackets.
 - 3. Handrails.
 - 4. Grab bars.
 - 5. Towel and bath accessories.
 - 6. Wall-mounted door stops.
 - 7. Interior signage.
 - 8. Chalkboards and marker boards.
 - 9. Wall paneling and trim.
 - 10. Joints of rigid wall coverings that occur between studs.
 - 11. At all locations noted on drawings for receiving Owner Furnished Displays, Projectors, paper product dispensers, or other wall mounted equipment.
 - 12. At all locations noted on drawings for receiving contractor or sub-contractor furnished Displays, Projectors, or other wall mounted equipment.

3.03 ROOF-RELATED CARPENTRY

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
- B. Provide blocking and nailers required by roofing assembly.
- C. Provide wood curb at roof openings except where prefabricated curbs are specified and where specifically indicated otherwise. Form corners by alternating lapping side members.
- D. Roof blocking shall be installed in accordance with FM Loss Prevention Data 1-90. The following shall be considered the minimum requirements for anchoring roof blocking. Provide a minimum of two (2) anchors per length of each piece of blocking, and within six (6) inches of each end. The Contractor shall provide additional fasteners as needed to suit specific job conditions. Perimeter roof blocking shall be secured to decking, structural steel, spaced steel angles, or plates as described below unless indicated otherwise on the Drawings:
 - 1. Roof blocking parallel to metal decking ribs: Secure blocking to joists or beams with 3/8" diameter bolts at no more than 4'-0" oc. Where joist or beam spacing is greater than 4'-0", bolt blocking to a continuous steel angle secured to the structure at maximum spacing of 4'-0" o.c. welded to the structure. As an alternative method, blocking may be secured to the deck with two rows of #10 stainless steel screws at twenty-four (24) inches o.c. with 5/8 inch diameter stainless steel washers.
 - 2. Roof blocking perpendicular to metal decking ribs: Secure blocking to the deck with two rows of #10 stainless steel screws at twenty-four (24) inches o.c. with 5/8 inch diameter stainless steel washers.
 - 3. Roof blocking anchored to masonry: Secure blocking with 1/2 inch diameter bolts, spaced a maximum of four (4) feet o.c., staggered if the blocking is wider than six (6) inches.

Within eight (8) feet of building corners, provide bolts at two (2) feet o.c. Bolts shall be embedded in grouted masonry cells a minimum depth of eight (8) inches.

4. For nailing layers of blocking to each other, provide nails in two (2) rows, staggered with spacing not to exceed 12 inches o.c. within the row. Nails to secure blocking to other blocking shall be galvanized and shall be long enough to penetrate 1-1/4 inch minimum.
- E. Form blocking in conjunction with perimeter roof fascias, gravel stops and membrane roofs to shapes as detailed. Shim as required to continuously align flush with top of abutting roof insulation, including added thickness of tapered insulation, where applicable. Shim as required to maintain a constant top of fascia/gravel stop elevation, where applicable.
- F. All curbs and blocking related to skylights, roof hatches, mechanical equipment and other roof mounted accessories shall be installed level and plumb and shall not necessarily follow the pitch of the roof, unless specifically indicated on the Drawings.

3.04 INSTALLATION OF CONSTRUCTION PANELS

- A. Construction Panels - General: Install in accordance with APA E30.
- B. Communications and Electrical Room Mounting Boards: Secure with screws to studs; space fasteners at maximum 24 inches on center.
 1. At fire-rated walls, install board over wallboard indicated as part of fire-rated assembly.
 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 3. Paint backerboards if not provided with factory applied finishes.
 4. Install adjacent boards without gaps.

3.05 SITE-APPLIED WOOD TREATMENT

- A. Apply preservative treatment to field-cut surfaces in accordance with manufacturer's instructions wherever cuts, holes, sawing, or other fabrication of wood members is required after pressure-preservative treatment.
- B. Apply preservative treatment in accordance with manufacturer's instructions.
- C. Allow preservative to dry prior to erecting members.

3.06 CLEANING

- A. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
- B. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 41 00
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Specially fabricated tall, base, wall cabinets and hardware.
- B. Preparation for installing utilities.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 54 - Wood Blocking and Curbing: Concealed blocking and support framing.
- B. Section 12 36 00 - Countertops.
- C. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.03 REFERENCE STANDARDS

- A. AWI/AWMAC/WI - Architectural Woodwork Standards.
- B. AWMAC/WI - North American Architectural Woodwork Standards.
- C. BHMA A156.9 - American National Standard for Cabinet Hardware.
- D. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.
- E. NEMA LD 3 - High-Pressure Decorative Laminates.

1.04 REGULATORY REQUIREMENTS

- A. All products and materials must be approved for sale in and meet local, State, and Federal regulations.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meeting: Convene a pre-installation meeting not less than three weeks before starting work of this Section; require attendance by all affected installers.
 - 1. Discuss wall cabinet cleat system, securement inspection and cabinet installation.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for all materials, finishes, hardware and products, including test results.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- D. Shop Drawings: Indicate materials, component profiles, thicknesses, fastening methods, jointing details, elevations, hardware locations, finishes and accessories. Include field dimensions on plans, elevations, sections at 1-1/2 inch to 1 foot scale, component profiles, connection and attachment details, and finish schedule. Indicate locations and types of building services connections and supplementary or concealed supports.
- E. Samples:
 - 1. Submit sample cabinet demonstrating construction, materials, hardware and finishes.
 - 2. Submit samples of pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish, unless otherwise directed by the Architect.

1.07 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this Section with minimum ten years of documented experience and with at least one project in the past 5 years with value of woodwork within 50 percent of cost of woodwork for this Project.
- B. Installer Qualifications: Same as fabricator.

1.08 PERFORMANCE REQUIREMENTS

- A. Architectural Casework shall meet the fabrication requirements of the Architectural Woodwork Standards (AWS) for Custom Grade.
- B. Incorporate systems and materials specified in other Sections and as indicated on the Drawings, including but not limited to glazing, electrical conduit, and communications cabling.
- C. Casework shall be configured as indicated on the Drawings and finished on all exposed and semi-exposed sides and sealed on all concealed faces.
- D. Structural Performance: Casework shall be capable of withstanding the effects of gravity loads, dead loads, and transverse loads.
 - 1. Cabinet shelving shall support 50 plf with a maximum deflection of L/180.
 - 2. Countertops shall support 100 plf for 24 inch deep counters with a maximum deflection of L/360.

1.09 MOCK-UPS

- A. Provide mock-up of typical base cabinet, wall cabinet, and countertop, including hardware, finishes, and plumbing accessories.
- B. See Section 01 40 00-Quality Requirements for additional requirements.
- C. Locate where directed.
- D. Mock-up may remain as part of the work.

1.10 PROJECT CONDITIONS

- A. Field Dimensions: The woodwork fabricator shall be responsible for coordinating the dimensions of all his work with actual field conditions, as well as with furniture, equipment and appliances to be furnished by others. The Contractor and fabricator shall cooperate to establish and maintain dimensions as required for a proper fit, without field modifications. Verify locations of concealed framing, blocking, reinforcements, and furring that support woodwork by accurate measurements before being enclosed.
- B. Acclimate casework to conditions indicated below for a minimum of 72 hours, prior to installing.
- C. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy. Installation areas shall be climate controlled between 60 and 90 degrees F with Relative Humidity maintained between 25 and 55 percent.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Protect units during transit, delivery, storage, and handling to prevent moisture and other damage, soiling and deterioration.
- B. Environmental Limitations: Do not deliver or install system and components until building is enclosed and finishing operations are complete, including adjacent ceiling and floor covering installation and painting.

PART 2 PRODUCTS

2.01 CABINETS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless indicted otherwise.
- B. Incorporate systems and materials specified in other Sections and as indicated on the Drawings, including but not limited to glazing, electrical conduit, and communications cabling.
- C. Casework shall be configured as indicated on the Drawings and finished on all exposed and semi-exposed sides and sealed on all concealed faces.

- D. Structural Performance: Casework shall be capable of withstanding the effects of gravity loads, dead loads, and transverse loads.
 - 1. Cabinet shelving shall support 50 plf with a maximum deflection of L/180.
 - 2. Countertops shall support 100 plf for 24 inch deep counters with a maximum deflection of L/360.
- E. Cabinet Finishes:
 - 1. Finish - Exposed Exterior Surfaces: Decorative laminate.
 - 2. Finish - Exposed Interior Surfaces: Decorative laminate.
 - 3. Finish - Semi-Exposed Surfaces: Decorative laminate
 - 4. Finish - Concealed Surfaces: Melamine.
 - 5. Door and Drawer Front Edge Profiles: Radius edge with applied thick band.
 - 6. Cabinet Style: Flush overlay.
 - 7. Cabinet Doors and Drawer Fronts: Flush style.

2.02 WOOD-BASED COMPONENTS

- A. Panel Core for Hardwood Veneer and Plastic Laminate Facing: Particle Board (PB); ANSI A208.1; Class M2, type as specified in AWI/AWMAC Architectural Woodwork Quality Standards Illustrated and herein; no urea formaldehyde-added (NAUF) or certified ultra-low emitting formaldehyde (ULEF), composed of wood fibers pressure bonded with water resistive adhesive to suit application; sanded faces; thicknesses as required.
 - 1. Density: 38.7 pcf minimum.
 - 2. Modulus of Elasticity: 290,100 psi minimum.
 - 3. Screw Holding Face: 202 lbs minimum.
 - 4. Screw Holding Edge: 180 lbs minimum.
 - 5. Note requirement for built-up thicknesses of bending substrate panels for curved cabinet
- B. Panel Core for Hardwood Veneer and Plastic Laminate Facing: Medium density fiberboard (MDF); ANSI A208.2; Class MD, type as specified in AWI/AWMAC Architectural Woodwork Quality Standards Illustrated and herein; no urea formaldehyde-added (NAUF) or certified ultra-low emitting formaldehyde (ULEF), composed of wood fibers pressure bonded with adhesive to suit application; sanded faces; thicknesses as required.
 - 1. Applications: Moisture resistant type for cabinets, panels and aprons below sinks and where indicated on the Drawings.
 - 2. Density: 47 pcf minimum.
 - 3. Modulus of Elasticity: 405,000 psi minimum.
 - 4. Screw Holding Face: 250 lbs minimum.
 - 5. Screw Holding Edge: 225 lbs minimum.
- C. Melamine: Thermo-fused, NEMA LD 3; particle board core as specified above; surfaced both faces; color white, unless otherwise indicated.
 - 1. Applications:
 - a. Drawer boxes.
 - b. Semi-concealed cabinet interiors, unless otherwise indicated below. See Laminate Materials.
- D. Panel thicknesses shall be as follows, unless otherwise indicated on the Drawings:
 - 1. Cabinet Tops and Bottoms: 3/4"
 - 2. Cabinet Ends, Supports and Divider Panels: 3/4"
 - 3. All Shelves: 3/4" up to 36" long and 1" over 36" long.
 - 4. Concealed Cabinet Backs: 3/8".
 - 5. Exposed Cabinet Backs: 3/4".
 - 6. Exposed Panels: 3/4".
 - 7. Doors and Drawer Fronts: 3/4".
 - 8. Sliding Doors: 1/2"

- 9. Cabinet Doors: 3/4".
- 10. Stiles, Rails and Trim: 3/4".
- 11. Cabinet Valances: 3/4".
- 12. Cabinet Aprons: 3/4".
- 13. Drawer Backs: 1/2".
- 14. Drawer Bottoms: 3/8".

2.03 LAMINATE MATERIALS

- A. Definitions:
 - 1. Exposed Cabinet Faces: Exterior cabinet faces, both sides of doors and cabinet interiors without doors.
 - 2. Semi-Exposed Cabinet Faces: Interior cabinet surfaces behind door and drawer fronts.
 - 3. Concealed Cabinet Faces: Faces that are total concealed to view.
- B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, indicated "P Lam" on the Drawings. See Finish Legend for manufacturers and colors. All panels shall be faced both sides for balanced construction.
- C. Provide specific types as indicated.
 - 1. Vertical Surfaces: VGS, 0.028 inch nominal thickness. For exposed vertical and horizontal surfaces, inside faces of cabinet doors. (inside cabinet bottoms).
 - 2. Horizontal bottom exposed surface inside locker cubbies: HGS, NEMA LD 3 Grade 0.048, nominal 1/16 inch thickness.
 - 3. Cabinet Liner: CLS, 0.020 inch nominal thickness. For semi-concealed reverse face of exposed surfaces, except as indicated.
 - 4. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.04 ACCESSORIES

- A. Adhesive: Urea formaldehyde-free. Type recommended by fabricator to suit application.
- B. Edge Banding: Extruded PVC or ABS, flat shaped with eased edges; smooth finish; of width to match component width. Banding thickness as follows:
 - 1. 3 mm applications: Door and drawer fronts, 4 sides; Cabinet body edges exposed; Shelf front edges exposed.
 - 2. 1 mm for semi-concealed cabinet box edge faces and drawer box edges.
 - 3. Color: As selected by Architect from manufacturer's standard range.
 - 4. Products: Accent Edge by Dolken Woodtape or Edge Banding by Charter Industries.
- C. Mounting Cleats: Solid hardwood; species is fabricator's option.
- D. Fasteners: Size and type to suit application.
- E. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- F. Concealed Joint Fasteners: Threaded steel.

2.05 HARDWARE

- A. Hardware: ANSI/BHMA A156.9, types as scheduled for quality grade specified. Finish of all hardware shall be US32D, unless otherwise indicated.
- B. Where single products are listed, equal products as manufactured by Bommer, Ives, Stanley, Knappe and Vogt, Hafele are acceptable.
 - 1. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Shelf Pin Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self-rests, anochrome finish, for nominal 1 inch spacing adjustments.

1. Product: Knappe and Vogt; 332ANO
- D. Drawer/Door Pulls: U shaped wire pull, stainless steel with satin finish, ADA compliant. 4-5/32 inch centers.
 1. Product: Doug Mockett; DP57B.
- E. Cabinet Locks: Combination lock. Provide for cabinets where noted.
 1. Scope: Carry cost for 20 percent of cabinets to receive locks. Cabinets to receive locks be indicated in shop drawing review.
 2. Product: Codelocks; KL1000RH.
- F. Catches: Magnetic. Use 2 on doors over 34" high.
 1. Product: Stanley; SP41.
- G. Silencers: Use two per drawer or door.
 1. Products: Bumper Specialties; BS-67SD.
- H. Drawer Slides, BHMA A156.9, Grade 1:
 1. Type: Full extension.
 2. Static Load Capacity: 150 lb minimum capacity per pair.
 3. Mounting: Side mounted.
 4. Stops: Integral type.
 5. Basis of Design Product:
 - a. Accuride; 3932
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- I. Hinges: European style concealed, BHMA A156.9, Grade 2. 120 degree opening; nickel plated steel with satin finish. .
 1. Products: Blum, Inc.; Clip Top.
- J. Coat Rod and Flanges: 1-1/16" diameter rod; heavy-duty; chrome finished steel.
 1. Product: # 770-1 rod, #734 / 735 flanges by Knappe & Vogt.
- K. Wiring Grommet: 2" outside diameter; plastic or metal; finish/color selected from manufacturer's full range.
 1. Product: Series TG by Doug Mockett Co. Inc.

2.06 FABRICATION

- A. Cabinet Style: Flush overlay.
- B. Cabinet Doors and Drawer Fronts: Flush style.
- C. Drawer Construction Technique: Doweled joints.
- D. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- E. Wall Cleats: Provide an interlocking wall cleat system at the top of wall cabinets. Interlocking cleats shall be 3/4" x 2-1/2" with 45 degree cut. Cabinet mounted cleat shall be glued and doweled to cabinet ends and glued to top and back of cabinet. The bottom cabinet cleat shall be secured to the cabinet similarly to the upper interlocking cleat. See Installation paragraph, for wall cleat mounting requirements. An interior clear dimension of 12" shall be maintained for wall cabinets, unless indicated otherwise on the Drawings.
 1. Wall cleats shall be sealed in clinical areas.
- F. Edging: Fit shelves, doors, and all edges with specified edging. Exposed and semi-exposed edges do not use more than one piece for any single length.
- G. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

- H. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
 - 1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
 - 2. Cap exposed plastic laminate finish edges with plastic trim.
- I. Note: There shall be no unfinished wood products. If not covered with plastic laminate products or otherwise finished, all wood surfaces shall be receive a minimum of one coat of sealer in concealed or semi-concealed areas.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing. Verify type of support framing for determination of proper fastener type. A minimum load of 60 pounds/LF for wall cabinets shall be supported. Provide a safety factor of 2.
- B. Verify location and sizes of utility rough-in associated with work of this Section.

3.02 INSTALLATION

- A. Install work in accordance with AWI/AWMAC/WI requirements for grade indicated.
- B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level. Install to a tolerance of 1/8" in 8'-0" for plumb and level and with 1/16" maximum offset in flush adjoining surfaces, 1/8" maximum offsets in revealed adjoining surfaces.
- C. Wall Cleat System:
 - 1. Wall mounted portion of the interlocking cleat system shall be secured to continuous 2x6 wood blocking concealed within the partition that is anchored to studs. Fasten wall cleat with #12 pan head or wood screws, minimum 2-1/2" long, maximum 8" on center, or a minimum of 2 per cabinet. Pre-drill holes in cleats. Cleat shall be a continuous piece where multiple cabinets are installed in a row.
 - 2. Wall cleat securement to wall blocking shall be inspected and confirmed by the Owner prior to proceeding with wall cabinet installation.
 - 3. Secure cabinet by first interlocking the cleat system. Secure cabinet to wall cleat with #12 wood screws, minimum 2-1/2" long, minimum 2 per cabinet per cleat at top cleat and at bottom cleat, following industry best practices.
 - 4. Cover screw heads inside the cabinets with white plastic plugs.
 - 5. Provide finished cabinet end panel if required to conceal end of wall cleat.
- D. Use concealed joint fasteners to align and secure adjoining cabinet units.
- E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- F. Secure cabinets to floor using appropriate angles and anchorages. Scribe base toe-kick board to uneven floor surfaces.
- G. Countersink anchorage devices at exposed locations. Plastic Laminate Cabinet Interiors shall include white plastic plugs.
- H. Install without distortion so that doors and drawers will fit openings properly and be accurately aligned.

3.03 ADJUSTING AND CLEANING

- A. Adjust moving or operating parts to function smoothly and correctly. Touch-up finishes to restore damaged or soiled areas. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

**SECTION 07 21 00
THERMAL INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Acoustic batt insulation in interior partitions.
- B. Thermal batt insulation at miscellaneous locations indicated on the Drawings.
- C. Foam insulation sealant for joints and small gaps.
- D. Adhesives, stick clips, tape, spring clips. and other accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 05 16 - Underslab Vapor Barrier: Installation of underslab vapor barrier.
- B. Section 07 54 23 – Thermoplastic-Polyolefin Roofing (TPO): Insulation specified as part of roofing system.
- C. Section 07 84 00 - Firestopping: Safing insulation as a component of firestopping assemblies.
- D. Section 09 21 16 - Gypsum Board Assemblies: Partitions for acoustic insulation.
- E. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.03 REFERENCE STANDARDS

- A. ASTM C165 - Standard Test Method for Measuring Compressive Properties of Thermal Insulations; 2023.
- B. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2023.
- C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.
- D. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2022.
- E. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).
- F. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).
- G. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2019 (Reapproved 2022).
- H. ASTM C1667 - Standard Test Method for Using Heat Flow Meter Apparatus to Measure the Center-of-Panel Thermal Transmission Properties of Vacuum Insulation Panels; 2015.
- I. ASTM D2126 - Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging; 2020.
- J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- K. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
- L. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024.
- M. ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres; 2020.

1.04 REGULATORY REQUIREMENTS

- A. All products and materials must be approved for sale in and meet local, State, and Federal regulations.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- D. Certifications: Evaluation Report indicating submitted products listed in wall assembly tested to NFPA 285-19 as required by IBC 2021. Provide reference to wall components provided in other Sections.
- E. Samples: Upon request, submit samples of each type of material to be used.

1.06 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

1.07 PROTECTION, HANDLING AND STORAGE

- A. Protect plastic insulation from exposure to sunlight, except as necessary for period of installation and concealment. Protect plastic insulation against ignition at all times. Do not deliver plastic insulation materials before installation time. Complete installation and concealment of plastic materials as quickly as possible.

PART 2 PRODUCTS

2.01 BATT & FIBER INSULATION MATERIALS

- A. Acoustical Batt Insulation: (Glass Fiber) ASTM C665, Type I, Class A; flexible preformed batt or blanket, friction fit; minimum 25% recycled content, formaldehyde-free.
 - 1. Surface Burning Characteristics, ASTM E84: Flame Spread Index 25 or less; Smoke Developed Index 450 or less.
 - 2. Thicknesses:
 - a. Partitions: Match thickness of stud cavity.
 - 3. Facing: Unfaced within stud walls.
 - 4. Products:
 - a. Owens Corning Corporation; Pink Next Gen Sound Attenuation Batts.
 - b. Johns Manville; Sound Shield Free.
 - c. Knauf; EcoBatt by Knauf.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Thermal Batt Insulation (Mineral Fiber): Flexible preformed batt or blanket, ASTM C665; friction fit, unfaced, formaldehyde-free.
 - 1. Application(s): All batt insulation indicated as "Thermal" and where batt insulation is indicated for installation in exterior perimeter walls, soffits and roof edge assemblies.
 - 2. Surface Burning Characteristics, ASTM E84: Flame spread index 0; Smoke developed index 0.
 - 3. Thermal Resistance: R-value of 3.5 per inch.
 - 4. Thickness: Where thickness is not indicated, furnish the maximum thickness appropriate for the proposed application.
 - 5. Products:
 - a. Rockwool; Comfortbatt.
 - b. Owens Corning Corporation; Thermafiber Fire & Sound Guard Plus FF.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.

- C. Mineral Fiber Firestopping Insulation (Safing Insulation): See Section 07 84 00.

2.02 FOAM INSULATION SEALANT

- A. Foam Insulation Sealant: Expanding, low VOC, HCFC and CFC-free, foam sealant
1. Application: Where indicated on Drawings, and at locations indicated below:
 - a. For infill of joints at Rigid Exterior Wall Insulation Board, provide product as approved by the rigid insulation manufacturer.
 - b. For perimeter sealant around windows, curtainwalls, door frames and other locations indicated on the Drawings, provide low-expansion type foam.
 - 1) Products:
 - (a) Premier Building Solutions; XtraFoam.
 - (b) Tremco; ExoAir LEF.
 - (c) Substitutions: See Section 01 60 00 - Product Requirements.

2.03 ACCESSORIES

- A. Adhesive: Gun grade, interior and exterior, and compatible with insulation and substrates; complies with ASTM C557.
1. Application Temperature: 40 to 100 degrees F at contact surfaces.
 - a. Volatile Organic Content (VOC): Less than 7 percent by weight.
 - b. Manufacturers:
 - 1) As recommended by insulation manufacturer & compatible with substrate.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 FIBEROUS BATT INSTALLATION

- A. Install fibrous batt insulation in accordance with manufacturer's instructions.
- B. Install thermal insulation at miscellaneous exterior wall and roof spaces without gaps or voids. Do not compress insulation.
- C. Install acoustic insulation between studs and other materials. Friction fit to prevent sliding and sagging. Provide additional clips and fasteners as required.
- D. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- E. Fit insulation completely to fill cavities and behind mechanical and electrical services within the plane of the insulation.
- F. All fibrous batt insulation shall be isolated from occupiable building spaces by gypsum board or other approved finish. Exposed insulation shall not be permitted in habitable areas.

3.03 FOAM INSULATION SEALANT INSTALLATION

- A. Install foam insulation following manufacturer's instructions and recommendations. Exercise caution not to overfill voids. Insulation shall be permitted to expand without causing the deflection of adjacent materials. Use non-expanding foam at perimeters of doors and windows.
- B. SPECIAL ATTENTION: Foam insulation sealant is NOT an acceptable substitution for sealing of penetrations or similar uses to provide continuation of exterior weather barrier substrate systems. Continuity of the weather barrier system MUST BE provided with approved flashings, membranes and sealants per Section 07 25 00 – no exceptions.

3.04 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 54 23
THERMOPLASTIC -POLYOLEFIN ROOFING (TPO)

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Patching and repair of existing roofing system and for addition of roof top units.
- B. TPO membrane roofing system and accessories.
- C. Coverboard.
- D. Insulation, flat and tapered.
- E. Vapor retarder.
- F. Deck underlayment.
- G. Membrane flashings.
- H. Stack boots, roofing expansion joints, and walkway pads.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 54 - Wood Blocking and Curbing: Wood nailers, blocking, plywood sheathing.
- B. Division 23 - HVAC: Mechanical equipment penetrating the roofing.

1.03 REFERENCE STANDARDS

- A. AAMA 611 – Voluntary Specification for Anodized Architectural Aluminum; 2020.
- B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).
- D. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.
- E. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023a.
- F. ASTM C 1153 - Standard Practice for Location of Wet Insulation in Roofing Systems Using Infrared Imaging
- G. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing 2017.
- H. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board 2023.
- I. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.
- J. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer; 2009 (Reapproved 2014).
- K. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2022.
- L. ASTM D1004 - Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting; 2013.
- M. ASTM D1079 - Standard Terminology Relating to Roofing and Waterproofing; 2020.
- N. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics; 2016 (Reapproved 2023).
- O. ASTM D1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics; 2020.

- P. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
- Q. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing; 2013.
- R. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- S. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.
- T. NRCA (RM) - The NRCA Roofing Manual 2024.
- U. NRCA (WM) - The NRCA Waterproofing Manual 2021.
- V. UL 790 - Standard Test Methods for Fire Tests of Roof Coverings Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate with installation of associated counter flashings and roof drainage components installed under other sections.
 - 2. Coordinate installation with adjacent flashings and air barrier systems for compatibility and continuity.
- B. Pre-installation Meeting: Convene at least two weeks before starting work of this Section, after the submission and review of roofing and flashing shop drawings, samples and printed data.
 - 1. Review preparation and installation procedures, coordination and scheduling necessary for related work, determine access, staging and storage areas, establish working weather conditions, roofing protection provisions, considerations for safety of building occupants and other relevant issues.
 - 2. Review preparation and installation procedures and coordinating and scheduling required with related work.
 - 3. Review continuous air barrier and continuous insulation requirements with Contractor's construction schedule. Discuss sequencing requirements for tie-in details to develop a tie-in detail schedule according to wall and roof product exposure requirements. Discuss inspection process and establish protocol to maintain inspection schedule with construction schedule.
 - 4. The following personnel shall be present:
 - a. Contractor (Project Manager, Superintendent)
 - b. Roofing Sub-Contractor (Project Manager, Foreman)
 - c. Roofing and Flashing Materials Manufacturers
 - d. Mechanical Sub-Contractor (Project Manager, Foreman)
 - e. Architect, Project Manager and Owner's Representative
 - 5. Verify compatibility of all materials in contact with roofing, including but not limited to:
 - a. Lumber blocking, treated and untreated.
 - b. Sealants and adhesives.
 - c. Waterstop membrane.
 - d. Thru wall flashing.
 - e. Insulations and roofing boards.
 - f. Vapor Retarders.
 - g. Deck underlayment.
 - h. All other roofing materials.
 - i. Substrates.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturer's written information listed below.
 - 1. Product data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements.
- C. Manufacturer's Assembly Letter: Certify that roofing assembly meets manufacturer warranty and code requirements, including edge metal.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, and other supplementary instructions.
- F. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.
- G. Warranty:
 - 1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
 - 2. Submit installer's certification that installation complies with all warranty conditions for the waterproof membrane.

1.06 QUALITY ASSURANCE

- A. Perform work in accordance with NRCA Roofing and Waterproofing Manual and manufacturer requirements.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum twenty years of documented experience.
 - 1. Manufacturer shall certify that the EPDM membrane formulation has not changed for a period not less than 10 years.
- C. Installer Qualifications: Company specializing in performing the work of this Section:
 - 1. With minimum ten years documented experience.
 - 2. Approved by membrane manufacturer.
 - 3. List of at least three projects contracted within the past five years of similar scope and complexity to this Project carried out by the firm and site supervisor.
- D. Materials Source Limitations: For each type of material required for the work of this Section, provide primary materials and accessories that are the products of the membrane manufacturer. Where alternate manufacturers for accessory components are to be used provide written documentation by the membrane manufacturer certifying such products for the intended use is acceptable and in compliance with membrane manufacturer specifications and warranty.
- E. Commencement of work by Contractor shall constitute acknowledgement by Contractor that this specification can be satisfactorily executed, under the project conditions and with all necessary prerequisites for warranty acceptance by roofing membrane manufacturer. No modification of the Contract Sum will be made for failure to adequately examine the Contract Documents or the project conditions.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.
- B. Protect products in weather protected environment, clear of ground and moisture.
- C. Protect foam insulation from direct exposure to sunlight.

- D. Keep Safety Data Sheets (SDS) at the project site at all times during transportation, storage, and installation of materials.
- E. Comply with requirements from Owner to prevent overloading or disturbance of the structure when loading materials onto the roof.

1.08 FIELD CONDITIONS

- A. Do not apply roofing membrane during unsuitable weather. Refer to manufacturer's written instructions.
- B. Do not apply roofing membrane when ambient temperature is below 40 degrees F or above manufacturers recommendations.
- C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- E. Proceed with work so new roofing materials are not subject to construction traffic as work progresses.
- F. Do not allow grease, oil, fats, or other contaminants to come into direct contact with membrane.

1.09 WARRANTY

- A. See Section 01 78 10 - Warranties.
- B. Applicator/Contractor Warranty: The roofing subcontractor hereby guarantees that all roofing items not covered by the roofing manufacturer's total system warranty shall be free from defective materials and workmanship for a period of two (2) years from the date of Substantial Completion. Upon notification of any such defects within said guarantee period the roofing subcontractor shall promptly make all necessary repairs and replacements at no cost or expense to the Owner. This warranty shall be signed and countersigned by the installer (Roofer) and the Contractor.
- C. Manufacturer's Total System Warranty: Roofing materials manufacturer shall furnish the Owner a "Total System" warranty insuring a watertight roof for a period of twenty five (25) years. The warranty shall cover all repairs necessary over the period up to the original cost of the original roofing contract. Warranty shall include maximum peak gust wind speed coverage of up to 90 mph and to include coverage for perimeter edge metal.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- 1. Basis of Design: Match existing roofing system. Holcim Elevate listed as basis of design for reference purposes only..
- 2. Products listed in this section are based on the basis of design manufacturer. Provide equivalents from substitute manufacturers if substitution is proposed.
- B. Acceptable Substitute Manufacturers:
 - 1. Carlisle SynTec Systems
 - 2. Johns Mansville.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ROOFING APPLICATIONS

- A. EPDM Membrane Roofing: One ply membrane, fully adhered, over insulation.
- B. Roofing Assembly Performance Requirements and Design Criteria:
 - 1. Roof Covering External Fire Resistance Classification: Class B when tested per UL 790.
 - 2. Wind Uplift:
 - a. Designed to withstand wind uplift forces calculated with ASCE 7.

- b. Design Wind Speed: In accordance with local building code and authorities having jurisdiction (AHJ).
- 3. Insulation Thermal Resistance (R-Value): Match existing.
- 4. Drainage: No standing water within 48 hours after precipitation.

2.03 ROOFING SYSTEM DESCRIPTION

- A. Description: TPO single-ply membrane.
 - 1. Membrane Attachment: Fully adhered.
 - 2. Warranty: Full system warranty; 25-year Red Shield limited warranty covering membrane, roof insulation, and membrane accessories.
 - 3. Deck Slope: Flat; provide slope of 1/4 inch per foot by means of tapered insulation where deck is not sloped.
 - 4. Comply with applicable local building code requirements.
 - 5. Provide assembly having Underwriters Laboratories, Inc. (UL) Class B fire hazard classification.
 - 6. Basic Wind Speed, Importance Factor, Exposure: See Structural Drawings.
- B. Components, from Top of Roof Down:
 - 1. Membrane: Thickness as specified below.
 - 2. Cover Board: Coated glass-mat faced gypsum board; adhered.
 - 3. Insulation:
 - a. Tapered Insulation: Minimum slope as indicated on drawings; provide minimum R-value at thinnest point; place tapered layer on top.
 - b. Minimum Insulation Thickness: Match existing.
 - c. Top Layer: Polyisocyanurate foam board, noncomposite; adhered.
 - 1) Fasteners terminate at Intermediate insulation layer to prevent thermal bridge of fasteners.
 - d. Intermediate Layer: Polyisocyanurate foam board, noncomposite; mechanically fastened.
 - e. Bottom Layer: Polyisocyanurate foam board, noncomposite; mechanically fastened.
 - f. Crickets: Tapered insulation of same type as specified for top layer; slope as indicated on drawings.
 - 4. Vapor Retarder: Self-adhering membrane.
 - 5. Deck Underlayment: Coated glass-mat faced gypsum board.

2.04 ROOFING MEMBRANE AND ASSOCIATED MATERIALS

- A. Single Source Responsibility: Provide and install products from single source.
- B. Membrane: Flexible, heat-weldable sheet composed of TPO polymer and ethylene propylene rubber; complying with ASTM D6878/D6878M, with polyester weft-inserted reinforcement and the following additional characteristics:
 - 1. Thickness: 0.06 inch plus/minus 10 percent, with coating thickness over reinforcement of 0.024 inch plus/minus 10 percent.
 - 2. Sheet Width: Provide widest available sheets to minimize field seaming.
 - 3. Puncture Resistance: 415 lbf, minimum, when tested in accordance with FTM 101C Method 2031.
 - 4. Puncture Resistance: 265 lbf, minimum, when tested in accordance with FTM 101C Method 2031.
 - 5. Solar Reflectance: 0.79, minimum, when tested in accordance with ASTM C1549.
 - 6. Color: White.
 - 7. Products:
 - a. Elevate; UltraPly TPO.

- C. Curb and Parapet Flashing: Same material as membrane, with encapsulated edge eliminating need for seam sealing flashing-to-roof splice; precut to 18 inches wide.
- D. Formable Flashing: Nonreinforced, flexible, heat-weldable sheet, composed of TPO polymer and ethylene propylene rubber.
 - 1. Thickness: 0.06 inch plus/minus 10 percent.
 - 2. Tensile Strength: 1,550 psi, minimum, when tested in accordance with ASTM D638 after heat aging.
 - 3. Elongation at Break: 650 percent, minimum, when tested in accordance with ASTM D638 after heat aging.
 - 4. Tearing Strength: 12 lbf, minimum, when tested in accordance with ASTM D1004 after heat aging.
 - 5. Color: White.
 - 6. Product: Elevate; UltraPly TPO Flashing.
- E. Tape Flashing: 5-1/2 inch nominal wide TPO membrane laminated to cured rubber polymer seaming tape, overall thickness 0.065 inch nominal.
 - 1. Product: Elevate; TPO QuickSeam Flashing.
- F. Bonding Adhesive: Manufacturer's recommended bonding adhesive formulated for compatibility with membrane and other substrate materials, including masonry, wood, and insulation facings.
- G. Pourable Sealer: Manufacturer's recommended two-part polyurethane, two-color for reliable mixing.
- H. Seam Plates: Steel with barbs and galvalume coating; corrosion resistance complying with FM 4470.
- I. Cut Edge Sealant: Use manufacturer's recommended sealant for exposed membrane reinforcement.
- J. General Purpose Sealant: Manufacturer's recommended, one part, white.
- K. Molded Flashing Accessories: Unreinforced TPO membrane premolded to suit variety of flashing details, including pipe boots, inside corners, outside corners, etc.
 - 1. Product: Elevate; UltraPly TPO Small and Large Pipe Flashing.
- L. Water Block Seal: Manufacturer's recommended butyl rubber sealant for use between two surfaces, unexposed.
- M. Termination Bars: Aluminum bars with integral caulk ledge; 1.3 inches wide by 0.1 inch thick.
 - 1. Product: Elevate; Termination Bar.
- N. Roof Walkway Pads: Nonreinforced TPO walkway pads, 30 inches wide with patterned traffic-bearing surface.
 - 1. Product: Elevate; UltraPly TPO Walkway Pads.
- O. Roof Sheet Vapor Retarder: Self-adhering, SBS-modified bitumen adhesive, factory-laminated to tri-laminate woven, high-density polyethylene top surface with release liner.
 - 1. Thickness: 30 mils, 0.03 inch, minimum.
 - 2. Low-Temperature Flexibility: 0.0325 inch at minus 30 degrees F when tested in accordance with ASTM D5147/D5147M.
 - 3. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
 - 4. Water Vapor Permeance: 0.04 perm, maximum, when tested in accordance with ASTM E96/E96M using Procedure B - Water Method.
 - 5. Water Penetration Resistance around Nails: Pass, when tested in accordance with ASTM D1970/D1970M.
 - 6. Product: Elevate; V-Force.

2.05 DECK UNDERLAYMENT AND COVER BOARDS

- A. Deck Underlayment: Noncombustible, water-resistant gypsum core with embedded glass mat facers, complying with ASTM C1177/C1177M, with the following additional characteristics:
 - 1. Water Absorption: 10 percent maximum, when tested in accordance with ASTM C473.
 - 2. Thickness: 5/8-inch.
 - 3. Surface Burning Characteristics: Flame spread index of 0, smoke developed index of 0, when tested in accordance with ASTM E84.
 - 4. Combustibility: Noncombustible, when tested in accordance with ASTM E136.
 - 5. Mold Growth Resistance: Zero growth, when tested in accordance with ASTM D3273 for minimum of four weeks.
 - 6. Pre-primed for adhered membrane applications.
 - 7. Products:
 - a. Georgia-Pacific; DensDeck Prime with EONIC Technology.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Insulation Coverboard: Noncombustible, water-resistant gypsum core with embedded glass mat facers, complying with ASTM C1177/C1177M, with the following additional characteristics:
 - 1. Water Absorption: 10 percent maximum, when tested in accordance with ASTM C473.
 - 2. Thickness: 1/2-inch.
 - 3. Compressive Strength: 900 psi, nominal.
 - 4. Surface Burning Characteristics: Flame spread index of 0, smoke developed index of 0, when tested in accordance with ASTM E84.
 - 5. Combustibility: Noncombustible, when tested in accordance with ASTM E136.
 - 6. Mold Growth Resistance: Zero growth, when tested in accordance with ASTM D3273 for minimum of four weeks.
 - 7. Pre-primed for adhered membrane applications.
 - 8. Products:
 - a. Georgia-Pacific; DensDeck Prime with EONIC Technology.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.06 INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by EPDM membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.
- B. Rigid Roof Insulation: Closed-cell polyisocyanurate foam laminated to facers, complying with ASTM C1289, Type II, Class 1, with the following additional characteristics:
 - 1. Provide polyisocyanurate insulation that meets PIMA Quality Mark Certified LTTR value through third party verification meeting ASTM C 1289, Type II, Class 1, Grade 2.
 - 2. Compressive Strength: 20 psi when tested in accordance with ASTM D1621.
 - 3. Ozone Depletion Potential: Zero; made without CFC- or HCFC-blowing agents.
 - 4. Mold Growth Resistance: Zero growth, when tested in accordance with ASTM D3273 for minimum of four weeks.
 - 5. Product:
 - a. Elevate; ISOGARD GL Polyisocyanurate Insulation.
- C. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.

2.07 ACCESSORIES

- A. Wood Nailers: See Section 06 10 54.

PART 3 EXECUTION

3.01 GENERAL

- A. Patching and repair work to be executed in manner required to maintain existing roofing warranty.

- B. Install roofing, insulation, flashings, and accessories in accordance with roofing manufacturer's published instructions and recommendations for specified roofing system. Where manufacturer provides no instructions or recommendations, follow NRCA (RM) written requirements and industry standards. Comply with federal, state, and local regulations.
- C. Obtain relevant instructions and maintain copies at project site for duration of installation period.
- D. Do not start work until preinstallation notice has been submitted to manufacturer.
- E. Provide temporary closures to ensure moisture does not damage completed roofing. Use flashings, terminations, and temporary closures to provide watertight installation.
- F. Protect adjacent construction, property, vehicles, and persons from damage related to roofing work; repair or restore damage caused by roofing work.
 - 1. Protect from spills and overspray from bitumen, adhesives, sealants, and coatings.
 - 2. Protect metal, glass, plastic, and painted surfaces from bitumen, adhesives, and sealants within range of windborne overspray.
 - 3. Protect finished areas of roofing system from roofing-related work traffic and traffic by other trades.

3.02 EXAMINATION

- A. Examine roof deck to determine deck is sufficiently rigid to support installers and mechanical equipment so deflection will not strain or rupture roof components or deform deck.
- B. Verify surfaces and site conditions are ready to receive work. Correct defects in substrate before commencing with roofing work.
- C. Examine roof substrate to verify adequate slope to drains.
- D. Verify specifications and drawing details are workable and not in conflict with roofing manufacturer's recommendations and instructions; start of work constitutes acceptable project conditions and requirements.

3.03 PREPARATION

- A. Remove existing roof system down to roof deck, including existing composition base flashings. Dispose of materials properly. Perform asbestos removal in accordance with federal, state, and local regulations, and dispose of waste in legal manner.
 - 1. At penetrations, remove existing flashings, including lead, asphalt, and mastic.
 - 2. Remove loose and unsecured flashings at walls, curbs, and other vertical and sloped surfaces; remove mineral-surfaced and coated flashings; remove excessive asphalt to provide smooth, sound surface for new flashings.
- B. Take appropriate measures to ensure fumes from adhesive solvents are not drawn into building through air intakes.
- C. Before proceeding, ensure roof surface is clean, dry, and smooth and free of sharp edges, fins, roughened surfaces, loose or foreign materials, oil, grease, and other materials that may damage membrane.
- D. Fill surface voids in immediate substrate greater than 1/4-inch wide with fill material acceptable insulation to membrane manufacturer.
- E. Wood Nailers: Provide wood nailers at perimeters and other locations where indicated on drawings.
 - 1. Install with 1/8-inch gap between each length and at each change of direction.

3.04 METAL DECK PREPARATION

- A. Install deck sheathing on metal deck.
 - 1. Lay with long side at right angle to flutes; stagger end joints; provide support at ends.
 - 2. Cut and install deck sheathing to provide smooth and flat surface.

3. Mechanically fasten deck sheathing to roof deck, in accordance with roofing manufacturer's instructions.

3.05 VAPOR RETARDER INSTALLATION

- A. Prime unprimed substrates using primer supplied by membrane manufacturer.
- B. Install vapor retarder in accordance with manufacturer's written instructions.
- C. Ensure penetrations and edge conditions are sealed to prevent moisture and air drive into roofing system.

3.06 INSULATION INSTALLATION

- A. Install insulation in accordance with manufacturer's written instructions.
- B. Install only as much insulation as can be covered with completed roofing system before end of day's work or before onset of inclement weather.
- C. Lay roof insulation in courses parallel to roof edges.
- D. Neatly and tightly fit insulation to penetrations, projections, and nailers, with gaps not greater than 1/4 inch. Fill gaps greater than 1/4 inch with manufacturer's recommended insulation. Do not leave roofing membrane unsupported over space greater than 1/4 inch.
- E. Mechanical Fastening: Using specified fasteners and insulation plates, engage fasteners through insulation into deck to depth and in pattern required by membrane manufacturer.
- F. Cold Adhesive Attachment: Apply in accordance with membrane manufacturer's instructions and recommendations; "walk-in" individual roof insulation boards to obtain maximum adhesive contact.

3.07 COVER BOARD INSTALLATION

- A. Install in accordance with membrane manufacturer's instructions and recommendations.
- B. Cold Adhesive Attachment: "Walk-in" individual boards to obtain maximum adhesive contact.

3.08 SINGLE-PLY MEMBRANE INSTALLATION

- A. Beginning at low point of roof, place membrane without stretching over substrate and allow to relax before attachment or splicing. Refer to membrane manufacturer's guidelines for minimum relaxation time.
- B. Lay out membrane pieces so field and flashing splices are installed to shed water.
- C. Install membrane without wrinkles and without gaps or fishmouths in seams; bond and test seams and laps in accordance with membrane manufacturer's instructions and details.
- D. Adhered Membrane: Bond membrane sheet to substrate using membrane manufacturer's recommended bonding material, application rate, and procedures.
- E. Edge Securement: Secure membrane at locations where membrane terminates or goes through angle change greater than 2 in 12 inches using mechanically fastened reinforced perimeter fastening strips, plates, or metal edging as indicated or as recommended by roofing manufacturer.
 1. Exceptions: Round pipe penetrations less than 18 inches in diameter and square penetrations less than 4 inches wide.
- F. Existing Roofing: Tie in new roofing to existing roofing systems as recommended by manufacturer and so as not to void existing roofing warranty. Provide and install compatible materials required for complete and watertight installation.

3.09 FLASHING AND ACCESSORIES INSTALLATION

- A. Install flashings, including laps, splices, joints, bonding, adhesion, and attachment, as required by membrane manufacturer's recommendations and details.

- B. Flashing at Walls, Curbs, and Other Vertical and Sloped Surfaces: Install weathertight flashing at walls, curbs, parapets, curbs, skylights, and other vertical and sloped surfaces.
 - 1. Extend flashing minimum 8 inches above membrane surface unless otherwise shown.
 - 2. Use longest practical flashing pieces.
 - 3. Evaluate substrate and overlay and adjust installation procedure in accordance with membrane manufacturer's recommendations.
 - 4. Complete splices between flashing and main roof sheet with specified splice adhesive before adhering flashing to vertical surfaces.
 - 5. Provide termination directly to vertical substrates as shown on roof drawings.
- C. Flashing at Penetrations: Flash penetrations passing through membrane; make flashing seals directly to penetration.
 - 1. Pipes, Round Supports, and Similar Items: Flash with specified premolded pipe flashings wherever practical; otherwise, use specified self-curing elastomeric flashing.
 - 2. Pipe Clusters and Unusual Shaped Penetrations: Provide penetration pocket at least 2 inches deep, with at least 1-inch clearance from penetration; fill with manufacturer's pourable sealer, and slope to shed water.
 - 3. Structural Steel Tubing: If corner radii are greater than 1/4 inch and longest side of tube does not exceed 12 inches, flash as for pipes; otherwise, provide standard curb with flashing.
 - 4. Flexible and Moving Penetrations: Provide weathertight gooseneck set in sealant and secured to deck, flashed as recommended by manufacturer.

3.10 FINISHING AND WALKWAY INSTALLATION

- A. Install walkways at access points to roof, around rooftop equipment requiring maintenance, and where indicated on drawings.
 - 1. Do not install walkway pads within 10 feet of roof edge or perimeter.
- B. Walkway Pads: Adhere to roofing membrane, spacing each pad at minimum of 1 inch and maximum of 3 inches from each other to allow for drainage.
 - 1. If installation of walkway pads over field-fabricated splices or within 6 inches of splice edge cannot be avoided, adhere another layer of flashing over splice and extending beyond walkway pad, minimum of 6 inches on either side.
 - 2. Prime membrane, remove release paper on pad, press in place, and walk on pad to ensure adhesion.

3.11 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Inspection by Manufacturer: Provide final inspection of roofing system by technical representative employed by roofing system manufacturer specifically to inspect installation for warranty purposes.
- C. Perform corrections necessary for issuance of warranty.

3.12 CLEANING

- A. Clean contaminants generated by roofing work from building and surrounding areas, including bitumen, adhesives, sealants, and coatings.
- B. Repair or replace building components and finished surfaces damaged or defaced due to work of this section; comply with recommendations of manufacturers of components and surfaces.
- C. Remove leftover materials, trash, debris, and equipment from project site and surrounding areas.

3.13 PROTECTION

- A. Where construction traffic continues over finished roof panels, provide durable protection and replace or repair damaged roofing to original condition.

END OF SECTION

**SECTION 07 81 00
APPLIED FIRE PROTECTION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fireproofing of interior structural steel not exposed to damage or moisture.

1.02 RELATED REQUIREMENTS

- A. Section 05 12 00 - Structural Steel Framing.
- B. Section 07 84 00 - Firestopping.
- C. Section 09 21 16 - Gypsum Board Assemblies: Gypsum board fireproofing.
- D. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.
- B. ASTM E605/E605M - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members 2019 (Reapproved 2023).
- C. ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members 2019 (Reapproved 2023).
- D. ASTM E760/E760M - Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members 1992 (Reapproved 2023).
- E. UL (FRD) - Fire Resistance Directory Current Edition.

1.04 REGULATORY REQUIREMENTS

- A. All products and materials must be approved for sale in and meet local, State, and Federal regulations.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.
- B. Product Data: Provide data indicating product characteristics.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- D. Test Reports: Independent testing agency reports for proposed products, indicating compliance with specified criteria, conducted under conditions similar to those on project, for:
 - 1. Bond strength.
 - 2. Bond impact.
 - 3. Compressive strength.
 - 4. Fire tests using substrate materials similar those on Project.
 - 5. Primers and other coatings applied to structural steel in the shop or field are compatible with fireproofing application.
- E. Manufacturer's Installation Instructions: Indicate special procedures.
- F. Manufacturer's Certificate: Certify that sprayed-on fireproofing products meet or exceed requirements of contract documents.
- G. Manufacturer's Field Reports: Indicate environmental conditions under which fireproofing materials were installed. Certify each fireproofing product is fully compatible with adhesives, primers, and other surface coatings on substrates intended to receive fireproofing.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section, with not less than ten years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience

1.07 REGULATORY REQUIREMENTS

- A. Environmental Compliance: Provide fireproofing products containing no detectable asbestos as determined according to the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, Polarized Light Microscopy.

1.08 DELIVERY, STORAGE AND PROTECTION

- A. Delivery: Materials shall be delivered in original sealed containers, clearly marked with suppliers name, brand name and type of material, and bearing U.L. label.
- B. Storage and Handling: Materials shall be stored off the ground and protected from the weather, in strict compliance with the manufacturer's recommendations.

1.09 FIELD CONDITIONS

- A. Do not apply fireproofing when temperature of substrate material and surrounding air is below 40 degrees F or when temperature is predicted to be below said temperature for 24 hours after application.
- B. Provide ventilation in areas to receive fireproofing during application and 24 hours afterward, to dry applied material.
- C. Provide temporary enclosure to prevent spray from contaminating air.

1.10 WARRANTY

- A. See Section 01 78 10 - Warranties, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
 - 1. Include coverage for fireproofing to remain free from cracking, checking, dusting, flaking, spalling, separation, and blistering.
 - 2. Reinstall or repair failures that occur within warranty period.

PART 2 PRODUCTS

2.01 FIREPROOFING ASSEMBLIES

- A. IBC Type II-B Construction. Provide fire resistance ratings for the following building elements as required by the building code:
 - 1. Primary structural frame, including columns, beams, girders, and trusses: 0 hour.
 - 2. Primary structural frame, including columns, beams, girders, and trusses supporting a roof only: 0 hour.
 - 3. Primary structural frame, including columns, beams, girders, and trusses, supporting fire rated construction: Equal to rating of fire rating supported.
 - 4. Bearing walls, exterior: 0 hour.
 - 5. Bearing walls, interior: 0 hour.
 - 6. Nonbearing walls and partitions, exterior: As indicated per the Drawings.
 - 7. Nonbearing walls and partitions, interior: As indicated per the Drawings.
 - 8. Floor construction, including supporting beams and joists: 0 hour, except where indicated on Drawings.
 - 9. Roof construction, including supporting beams and joists and deck: 0 hour.
- B. UL Assemblies: See tested assemblies included in annex of this Project manual. The following assemblies are based on the Basis of Design product. Submit equivalent assemblies if Acceptable Substitute Manufacturers are substituted for the Basis of Design product.
 - 1. Columns: 1 Hour Rating - UL No. X790.

2. Floor Beams: 1 Hour Rating - UL No. N759.
3. Bar Joists: 1 Hour Rating - UL No. N792.

2.02 MATERIALS

- A. Spray-Applied Fireproofing: Commercial (low) density sprayed fire-resistive material, factory mixed, cementitious material blended for uniform texture with mineral aggregates (gypsum based) for interior use.
 1. Applications: Interior concealed locations.
 2. Bond Strength, ASTM E 736: Minimum 150 psf when set and dry.
 3. Dry Density, ASTM E 605: Minimum 15 lb/cu ft.
 4. Compressive Strength, ASTM E 761: 10% deformation at 100 psi.
 5. Effect of Impact on Bonding, ASTM E 760: No cracking, flaking or delamination.
 6. Surface Burning Characteristics, ASTM E84: Maximum Flame Spread of 0 and Smoke Developed of 0.
 7. Air Erosion, ASTM E859: Maximum allowable weight loss 0.025 g/sq ft.
 8. Fungal Resistance, ASTM G21: No growth after 28 days.
 9. Corrosion Resistance ASTM E937: No contribution to corrosion of steel.
 10. Basis of Design Product:
 - a. Isolatek International; CAFCO 300.
 - b. Acceptable Substitute Manufacturers:
 - 1) Grace Construction Products; MK-6 series
 - 2) Carbolite; Southwest Type 5GP.
 - 3) Substitutions: See Section 01 60 00 - Product Requirements.

2.03 ACCESSORIES

- A. Primer Adhesive: Of type recommended by applied fireproofing manufacturer.
- B. Overcoat/Sealer: As recommended by manufacturer of applied fireproofing material.
- C. Water: Clean, potable.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive fireproofing.
- B. Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.
- C. Verify that ducts, piping, equipment, or other items that would interfere with application of fireproofing have not been installed.
- D. Verify that voids and cracks in substrate have been filled.
- E. Verify that projections have been removed where fireproofing will be exposed to view as a finish material.

3.02 PREPARATION

- A. Perform tests as recommended by fireproofing manufacturer in applications where adhesion of fireproofing to substrate is in question.
- B. Remove incompatible materials that could effect bond by scraping, brushing, scrubbing, or sandblasting.
- C. Prepare substrates to receive fireproofing in strict accordance with instructions of fireproofing manufacturer.
- D. Apply fireproofing manufacturer's recommended bonding agent on primed steel.
- E. Protect surfaces not scheduled for fireproofing and equipment from damage by overspray, fall-out, and dusting.

- F. Close off and seal duct work in areas where fireproofing is being applied.

3.03 APPLICATION

- A. Install metal lath over structural members as indicated or as required by UL Assembly Design Numbers.
- B. Apply primer adhesive in accordance with manufacturer's instructions.
- C. Apply fireproofing in thickness and density necessary to achieve required ratings, with uniform density and texture. Apply in one coat unless otherwise recommended in writing by the manufacturer.
- D. Metal Decks: Do not apply fireproofing to underside of metal floor deck until concrete, if any has been completed. Do not apply fireproofing to underside of metal roof deck until roofing has been completed. Prohibit roof traffic during application and drying of fireproofing.
- E. Cure fireproofing according to manufacturer's written recommendations.
- F. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, tested and any required corrections have been made.
- G. Finishes: Apply fireproofing to product the following finishes:
 - 1. Standard Spray-Texture Finish: Finish according to manufacturer's written instructions for spray-application with no further treatment.
 - a. Applications: Fireproofing to be concealed.

3.04 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 40 00 - Quality Requirements.
- B. The Owner's testing and inspection agency shall test and inspect fireproofing after application and curing, prior to its concealment.
- C. Ensure that actual thicknesses, densities, and bond strengths meet requirements for specified ratings and requirements of authorities having jurisdiction (AHJ).
- D. Fireproofing shall be tested in accordance with ASTM E605 and ASTM E736 in areas as described below. Do not proceed with fireproofing of next area until test results for previously completed work indicate compliance with requirements.
 - 1. Thickness: Floor, Roof and Wall Assemblies: Floor, roof and wall assembly thickness measurements shall be taken at not less than four (4) random locations for each 1,000 sf of floor, roof and wall surface.
 - 2. Thickness: Structural Framing Members: Structural framing members thickness measurements shall be taken at not less than 25% of the structural members on each floor.
 - 3. Density: Samples for density determination shall be taken at a rate of not less than one test for each 10,000 sf of sprayed areas in each story, but in no case shall there be less than two per story.
 - 4. Bond Strength: Floor, Roof, and Wall Assemblies: Samples for cohesion/adhesion shall be taken on thoroughly dried material at the rate of not less than one test for each 10,000 sf, or part thereof of the sprayed areas in each story.
 - 5. Bond Strength: Structural Framing Members: Samples for cohesion/adhesion shall be taken on thoroughly dried material at the rate of not less than one test for each type of structural framing member for each 10,000 sf of floor area or part thereof in each story.
- E. Testing agency shall report test results promptly and in writing to the Contractor, Owner, and Architect.
- F. Repair or replace fireproofing within areas where test results indicate fireproofing does not comply with requirements.

- G. Apply additional fireproofing per manufacturer's directions where test results indicate that the thickness does not comply with specified requirements.
- H. Where fireproofing is removed and replaced or repaired, additional testing will be performed to determine compliance with specified requirements. Any re-tests for areas not in compliance shall be paid for by the Contractor.

3.05 CLEANING

- A. Remove excess material, overspray, droppings, and debris.
- B. Remove fireproofing from materials and surfaces not required to be fireproofed.
- C. At exposed fireproofing, clean surfaces that have become soiled or stained, using manufacturer's recommended procedures.
- D. Remove overspray from piping, electrical devices, ductwork, etc. All floor areas shall be broom cleaned.

END OF SECTION

SECTION 07 84 00
FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Firestopping systems for all penetrations and interruptions to fire-rated assemblies, smoke barriers, fire rated floor assemblies, whether indicated on drawings or not, and other openings indicated. See the Drawings for assembly fire ratings.
- B. Identification signage.

1.02 RELATED REQUIREMENTS

- A. Section 01 45 33 – Code-Required Special Inspections
- B. Section 01 45 33.1 – General Statement of Special Inspections: 3rd party firestop inspection requirements.
- C. Section 07 81 00 - Applied Fire Protection.
- D. Section 07 90 05 – Joint Sealers: Sealant for head of wall joints and penetrations in non-fire rated partitions indicated as smoke partitions or having an acoustical rating.
- E. Section 09 21 16 - Gypsum Board Assemblies: Gypsum wallboard fireproofing and deflection head track types.
- F. Division 21 - Fire Protection: Firestopping of fire protection work.
- G. Division 22 - Plumbing: Firestopping of plumbing work.
- H. Division 23 - HVAC: Firestopping of heating, ventilating and air conditioning work.
- I. Division 26 - Electrical: Firestopping of electrical work.
- J. Division 27 – Communications: Firestopping of communications work.
- K. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.03 REFERENCE STANDARDS

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.
- C. ASTM E1966 - Standard Test Method for Fire Resistive Joint Systems; 2015 (Reapproved 2019).
- D. ASTM E2174 – Standard Practice for On-Site Inspection of Installed Firestop Systems; 2020a.
- E. ASTM E2393 – Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2020a.
- F. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2023b.
- G. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2023a.
- H. ITS (DIR) - Directory of Listed Products; current edition.
- I. FM (AG) - Approval Guide; current edition.
- J. UL 1479 – Standard for Fire Test of Penetration Firestops, Current Edition, Including All Revisions.
- K. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

- L. UL - Fire Resistance Directory; current edition.

1.04 DEFINITIONS

- A. Annular Space is the opening around an item (pipe, duct, etc.) penetrating a construction assembly.
- B. Fire-resistance is the property of materials or their assemblies that prevents or retards the passage of excessive heat, hot gases, or flames under conditions of use.
- C. Fire-resistive joint system is the assemblage of specific materials or products that are designed, tested and fire-resistance rated in accordance with ASTM E119 to resist for a prescribed period of time the spread of fire through joints in or between fire-resistance rated assemblies.
- D. Firestopping is a specific assembly of materials or products fill openings and annular spaces around penetrating items (such as cables, cable trays, conduits, ducts, pipes) and their means of support through the wall, floor, ceiling or roof to prevent spread of fire and includes fire-resistive joint systems and through-penetration firestop systems.
- E. Through-penetration is an opening that passes entirely through a fire-resistance rated assembly.
- F. Through-penetration firestop system is a specific assembly of materials that are designed, tested and installed to prevent the spread of fire through openings in fire-resistive rated floors and walls to accommodate through-penetrations of electrical, mechanical, plumbing, and communications systems.
- G. F-rating indicates the period of time that the through-penetration firestop system is capable of preventing the passage of flame to the unexposed (non-fire) side of the assembly in conjunction with an acceptable hose stream test performance.
- H. T-rating indicates the period of time that the through-penetration firestop system is capable of preventing the passage of flame and temperature rise of 325 degrees F. above ambient temperature on the unexposed (non-fire) side of the assembly in conjunction with an acceptable hose stream test performance.

1.05 REGULATORY REQUIREMENTS

- A. All products and materials must be approved for sale in and meet local, State, and Federal regulations.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance ratings, and limitations. A coordinated submittal shall be prepared for all firestopping used on the Project.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- D. Shop Drawings: Submit manufacturer's illustrated test assembly shop drawings detailing materials, installation methods, and relationships to adjoining construction for each through-penetration firestop system and fire-resistant joint system, each construction condition and type of penetration or joint. Include firestop design designation from the approved testing agency (UL, for example).
 - 1. For those firestop applications for which no tested system is available from the manufacturer, the manufacturer's engineering judgment derived from similar tested system designs or other tests shall be submitted to the Authority Having Jurisdiction for their review and approval prior to installation.
 - 2. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
 - 3. One firestopping submittal shall cover products used for all phases of multi-phase projects.
- E. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

- F. Installer Qualification Statement: Submit qualification statements for installing mechanics.

1.07 QUALITY ASSURANCE

- A. Single Source: If the Contractor determines that individual trades (i.e. mechanical, plumbing, fire protection, electrical) shall be responsible for firestopping their penetrations, instead of all firestopping provided by a single contractor, products used shall be coordinated among the various trades by the Contractor so that multiple products or manufacturers are NOT used for the same type of application.
1. The Contractor shall provide a coordinated submittal for all firestopping used on the Project.
- B. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
1. Listing in the current-year classification or certification books of UL, FM, or ITS (Warnock Hersey) will be considered as constituting an acceptable test report.
 2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
 3. For those firestop applications that exist for which no approved tested system is available through a manufacturer, an engineered judgment derived from similar system designs or other approved tests shall be submitted to the local Authority Having Jurisdiction for review and approval prior to installation. Engineering judgment drawings shall follow requirements set forth by the International Firestop Council.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum ten years documented experience.
- D. Installer Qualifications: Company or personnel specializing in performing the work of this Section, trained by the firestop manufacturer(s) and with a minimum of 3 years documented experience installing work of this type. Submit written qualifications statements for installing mechanics.

1.08 MOCK-UP

- A. Install one firestopping assembly representative of each fire rating design required on Project.
1. Where one design may be used for different penetrating items or in different wall constructions, install one assembly for each different combination.
 2. Where firestopping is intended to fill a linear opening, install minimum of 1 linear ft.
- B. Obtain approval of authority having jurisdiction and testing agency before proceeding.
- C. Remove and replace unsatisfactory mock-ups. Accepted mock-ups shall represent minimum standards for the Work.
- D. Accepted mock-ups may remain as part of the Work.

1.09 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 FIRESTOPPING GENERAL REQUIREMENTS

- A. Firestopping: All products shall be by one of the following acceptable manufacturers and shall be specific for each construction condition, fire-resistance requirement, and annular size. Multiple products shall not be used for the same application. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
- B. Basis of Design: Hilti Inc.

- C. Acceptable Manufacturers:
 - 1. 3M Fire Protection Products.
 - 2. Tremco Commercial Sealants & Waterproofing.
 - 3. A/D Fire Protection Systems, Inc.
 - 4. Nelson FireStop Products.
 - 5. Specified Technologies, Inc.
 - 6. RectorSeal, a CSW Industrials Company.
 - 7. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

2.02 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. General:
 - 1. Provide firestopping for conditions specified whether or not firestopping is indicated on the Drawings in partition and floor assemblies indicate as fire rated. It is intended that firestopping shall be provided at all fire-resistive assemblies and at all floor assemblies as required by applicable laws and codes.
 - 2. Insulation types specified in other Sections other than fiber firestopping insulation, shall not be installed in lieu of firestopping material specified herein, unless specified as a component of a tested fire-resistive joint assembly or a through-penetration firestop assembly.
- B. Interior Walls and Partitions:
 - 1. Provide firestopping at all voids between rated floor assemblies and rated walls. Provide firestopping whether or not there are any clips, angles, plates or other members bridging or interconnecting the wall and floor systems, and whether or not such items are continuous.
 - 2. Provide firestopping at all voids where the top edge of a fire-resistant wall abuts decking.
 - 3. Provide firestopping at all construction joints, cracks, structural member penetrations, mechanical or electrical equipment penetrations, and any other openings in fire-resistant construction.
- C. Penetrations:
 - 1. Penetrations include sleeves, conduits, cables, wires, piping, ducts, expansion joints, structural members, or other elements that pass through one or both outer surfaces of fire-resistive floors, roofs, partitions, or walls, and all floor assemblies.
- D. Provide firestop systems manufactured and installed to resist spread of fire, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated for:
 - 1. Fire rated load-bearing walls and non-load bearing partitions.
 - 2. Fire rated floor assemblies and roof assemblies
- E. Fire Ratings: Use system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements. See Drawings for required fire ratings.
- F. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Fire-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
 - 1. Movement: Provide systems that have been tested to show movement capability as indicated.
 - 2. Provide system tested in accordance with ASTM E90 with STC rating of 50, minimum.

- F. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa). Fire-resistance-rated walls include fire walls and fire-barrier walls.
 - 1. F-ratings as determined by ASTM E814, but not less than that equaling or exceeding fire resistance rating of the construction penetrated.
 - 2. Provide system tested in accordance with ASTM E90 with STC rating of 50, minimum.
- G. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
 - 1. Horizontal assemblies include floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
 - 2. F-Rating: At least 2 hour, but not less than the fire-resistance rating of constructions penetrated.
 - 3. T-Rating: At least 2 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
 - 4. Provide firestop systems with T-ratings in addition to F-ratings as determined by ASTM E814, where systems protect penetrations located outside wall cavities, located outside fire-resistive shaft enclosures, located in construction containing fire protection rated openings and at penetrating items larger than 4 inches in diameter pipe or 16 sq inches cross sectional area.
 - 5. Provide system tested in accordance with ASTM E90 with STC rating of 50, minimum.
- H. For firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.
 - 1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant firestop systems.
 - 2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means.
 - 3. For penetrations involving insulated piping, provide firestop systems not requiring removal of insulation.
 - 4. For firestop systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed.
- I. Provide firestop systems that are compatible with one another and the substrates they are in contact with based on testing and field experience.
- J. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the VOC limit contents per 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
- K. Mold and Mildew Resistance: Provide firestopping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.

2.03 OTHER MATERIALS

- A. Accessories: Provide components for each firestop system that are needed to install fill materials and to comply with performance requirements. Use only components specified by firestop system manufacturer and approved by the qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:
 - 1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-/rock-wool-fiber safing insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.

- c. Fire-rated form board.
 - d. Fillers for sealants.
 - e. Substrate primers.
 - f. Collars.
 - g. Steel sleeves
- B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
- D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrating item.
- E. Intumescent Putties: Non-hardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogeneous mortar.
- H. Pillows/Bags: Reusable heat-expanding pillows/bags.
- I. Silicone Foam: Multi-component, silicone-based liquid elastomer that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants, pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and non-sag formulation for openings in vertical and other surfaces requiring a non-slumping, gunnable sealant, unless indicated firestop system limits use to non-sag grade for both opening conditions.
- K. Caulking Compound (fire sealant): Material approved by the safing insulation manufacturer for sealing joints between foil backing of safing insulation and edge of concrete floor slab against smoke penetration.
- L. Safing Clips: Galvanized steel safing clips approved by the safing insulation manufacturer for holding insulation in place.
- M. M. Sleeves for through-penetrations shall be of non-combustible materials and securely fastened to the assembly penetrated. Sleeves through floors in exposed locations, behind kitchen cooking line equipment for piping and conduit, for example, shall extend 1" above the floor surface to stop water seepage to floor below.
- N. Identification Signage: Pressure sensitive self-adhesive, preprinted vinyl labels; including the following information on labels:
- 1. "Warning - Through Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, phone number.
 - 3. Firestop system designation of applicable testing and inspecting agency (UL or WH).
 - 4. Date of installation.
 - 5. Firestop system manufacturer's name.
 - 6. Installer's name.
- O. Primers: Type required for tested assembly design.
- P. Mineral Fiber Firestopping Insulation (Safing Insulation): ASTM C665 Type 1, unfaced, high-melt mineral fiber batt and have the following properties:

1. Thickness: As required by tested assemblies.
2. Density, ASTM D1622: 4 pcf.
3. Surface Burning Characteristics, ASTM E84: Flame Spread Index 15, Smoke Developed Index 0.
4. Water Absorption, ASTM C 272: 0.1% by volume
5. Accessories: Manufacturer's "Z" impaling clips as required.
6. Curtainwall Applications: Provided as part of Perimeter Fire Containment Firestopping. Provide product as referenced in specified assembly.
7. Use preformed mineral wool designed to fit flutes of metal profile deck and gap between top of wall and metal deck profile where part of submitted design.
 - a. Hilti; Speed Plugs and Strips.
8. Products:
 - a. Rockwool; Roxul Safe.
 - b. Owens Corning; Thermafiber Safing Insulation.
 - c. Johns Manville; MinWool Safing.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 FIRESTOPPING FOR PERIMETER CONTAINMENT

- A. Perimeter Joint Systems That Have Not Been Tested For Movement Capabilities (Static-S):
 1. Applications:
 - a. Typical Installation; Rated Floor Deck to Rated Exterior Stud Wall and Rated Floor Deck to Rated Interior Stud Wall:
 - 1) Basis of Design Assembly: 1 Hour Construction: Hilti/Intertek System HI/BP 120-04; Hilti CFS-SP WB Spray or CFS-SP SIL Spray.
 - 2) Substitutions: See Section 01 60 00 - Product Requirements.

2.05 FIRESTOPPING FOR FLOOR-TO-FLOOR, WALL-TO-FLOOR, AND WALL-TO-WALL JOINTS

- A. May include, but not limited to the following firestopping assemblies.
- B. Concrete and Concrete Masonry Walls and Floors:
 1. Floor to Floor Joints:
 - a. 1 Hour Construction: UL System FF-D-1013; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
 2. Top of Wall Joints at Concrete/Concrete Masonry Wall to Concrete Over Metal Deck Floor:
 - a. 1 Hour Construction: UL System HW-D-1037; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
 3. Top of Wall Joints at Concrete/Concrete Masonry Wall to Concrete Floor:
 - a. 1 Hour Construction: UL System HW-D-0268; Hilti CP 606 Flexible Firestop Sealant.
 4. Concrete/Concrete Masonry Wall to Wall Joints:
 - a. 1 Hour Construction: UL System WW-D-0032; Hilti CP 606 Flexible Firestop Sealant.
- C. Gypsum Board Walls:
 1. Wall to Wall Joints:
 - a. 1 Hour Construction: UL System WW-D-0067; Hilti CP 606 Flexible Firestop Sealant.
 2. Top of Wall Joints at Underside of Steel Beam and Concrete Over Metal Deck Floor with Sprayed On Fireproofing:
 - a. 1 Hour Construction: UL System HW-D-0259; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
 3. Top of Wall Joints at Concrete Over Metal Deck, Wall Parallel to Ribs:
 - a. 1 Hour Construction: UL System HW-D-0049; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
 4. Top of Wall Joints at Concrete Over Metal Deck, Wall Perpendicular to Ribs, Cut to Fit Ribs:
 - a. 1 Hour Construction: UL System HW-D-0045; Hilti CP 606 Flexible Firestop Sealant.
 5. Top of Wall Joints at Concrete Over Metal Deck, Wall Perpendicular to Ribs, Not Cut to Fit:

- a. 1 Hour Construction: UL System HW-D-0042; Hilti CFS-SP WB Firestop Joint Spray and CP 672.

2.06 FIRESTOPPING PENETRATIONS THROUGH CONCRETE AND CONCRETE MASONRY CONSTRUCTION

- A. May include, but not limited to the following firestopping assemblies:
- B. Blank Openings:
 - 1. In Floors or Walls:
 - a. 1 Hour Construction: UL System C-AJ-0090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
- C. Penetrations Through Floors or Walls By:
 - 1. Multiple Penetrations in Large Openings:
 - a. 1 Hour Construction: UL System C-AJ-8143; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - 2. Uninsulated Metallic Pipe, Conduit, and Tubing:
 - a. 1 Hour Construction: UL System C-AJ-1421; Hilti FS-ONE MAX Intumescent Firestop Sealant or CP 604 Self-Leveling Firestop Sealant.
 - 3. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
 - a. 1 Hour Construction: UL System C-AJ-2567; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - b. 1 Hour Construction: UL System C-AJ-2109; Hilti CP 643N/644 Firestop Collar.
 - 4. Cable Trays with Electrical Cables:
 - a. 1 Hour Construction: UL System C-AJ-4094; Hilti CFS-BL Firestop Block.
 - 5. Insulated Pipes:
 - a. 1 Hour Construction: UL System C-AJ-5091; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - b. 1 Hour Construction: UL System C-AJ-5048; Hilti FS-ONE MAX Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CP 601S Elastomeric Firestop Sealant, or CP 604 Self-Leveling Firestop Sealant.
 - 6. HVAC Ducts, Uninsulated:
 - a. 1 Hour Construction: UL System C-AJ-7111; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - b. 1 Hour Construction: UL System C-AJ-7084; Hilti FS-ONE MAX Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CP 601S Elastomeric Firestop Sealant, or CP 604 Self-Leveling Firestop Sealant.
- D. Penetrations Through Floors By:
 - 1. Multiple Penetrations in Large Openings:
 - a. Hour Construction: UL System F-A-8012; Hilti CFS-S SIL GG Firestop Silicone Sealant Gun-Grade or CFS-S SIL SL Firestop Silicone Sealant Self-Leveling.
 - 2. Uninsulated Metallic Pipe, Conduit, and Tubing:
 - a. 1 Hour Construction: UL System F-A-1016; Hilti CP 680-P/M Cast-In Device.
 - 3. Floor Drains or Toilet Flanges:
 - a. 1 Hour Construction: Manufacturer standard detail or engineering judgement.
- E. Penetrations Through Walls By:
 - 1. Uninsulated Metallic Pipe, Conduit, and Tubing:
 - a. 1 Hour Construction: UL System W-J-1067; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - 2. Insulated Pipes:
 - a. 1 Hour Construction: UL System W-J-5041; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - 3. HVAC Ducts, Uninsulated:

- a. 1 Hour Construction: UL System W-J-7109; Hilti FS-ONE MAX Intumescent Firestop Sealant or CP 606 Flexible Firestop Sealant.
- 4. HVAC Ducts, Insulated:
 - a. 1 Hour Construction: UL System W-J-7112; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2.07 FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS

- A. May include, but not limited to the following firestopping assemblies:
- B. Blank Openings:
 - 1. Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
- C. Penetrations By:
 - 1. Multiple Penetrations in Large Openings:
 - a. 1 Hour Construction: UL System W-L-1408; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - b. 1 Hour Construction: UL System W-L-8071; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - c. 1 Hour Construction: UL System W-L-8079; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - 2. Uninsulated Metallic Pipe, Conduit, and Tubing:
 - a. 1 Hour Construction: UL System W-L-1054; Hilti FS-ONE MAX Intumescent Firestop Sealant. MAX
 - b. 1 Hour Construction: UL System W-L-1164; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - 3. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
 - a. 1 Hour Construction: UL System W-L-2078; Hilti CP 643N/644 Firestop Collar.
 - b. 1 Hour Construction: UL System W-L-2128; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - 4. Electrical Cables Not In Conduit:
 - a. 1 Hour Construction: UL System W-L-3065; Hilti FS-ONE MAX Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CD 601S Elastomeric Firestop Sealant, or CP 618 Firestop Putty Stick.
 - b. 1 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
 - 5. Cable Trays with Electrical Cables:
 - a. 1 Hour Construction: UL System W-L-4011; Hilti CFS-BL Firestop Block.
 - b. 1 Hour Construction: UL System W-L-4060; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - 6. Insulated Pipes:
 - a. 1 Hour Construction: UL System W-L-5028; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - b. 1 Hour Construction: UL System W-L-5029; Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - 7. HVAC Ducts, Insulated:
 - a. 1 Hour Construction: UL System W-L-7156; Hilti FS-ONE MAX Intumescent Firestop Sealant.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify openings are ready to receive the work of this Section.
- B. Review substrates, joint conditions, and penetrating objects. If conditions do not meet the requirements of the tested assembly provided in the firestopping schedule, request additional details from the manufacturer. If details do not exist for the conditions, request an engineering

judgment from the firestopping manufacturer to provide a documented firestopping assembly for the condition.

3.02 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.

3.03 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Coordinate with mechanical, fire protection, electrical, and other trades to assure that all pipes, conduits, cable trays, cables, ducts, and other items that penetrate fire-resistant construction are properly firestopped.
- C. Install dams where recommended or required by tested fire-resistive joint assemblies and through-penetration firestop systems. Combustible damming material and other accessories not indicated as permanent components of firestop systems shall be removed after appropriate curing.
- D. Install firestopping materials in conjunction with fiber firestopping insulation (firesafing insulation) as required by tested assemblies.
- E. Where cable trays penetrate fire-resistant wall assemblies, provide pillow type firestop product. All cabling /wiring sleeves whether empty or utilized for wiring through fire-resistant assemblies shall be firestopped.
- F. Do not cover installed firestopping until inspected by Authority Having Jurisdiction and/or testing agency.
- G. Install perimeter fire containment firestopping in accordance with tested assemblies and manufacturer instructions.

3.04 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.05 IDENTIFICATION

- A. Identify all firestop system locations with pressure sensitive self-adhesive, pre-printed vinyl labels.
 - 1. Attach labels permanently to both sides of penetrated construction surfaces and joints in fire-rated construction.
 - 2. Labels shall be visible to anyone seeking to disturb or remove penetrating items or firestop system. Where possible, labels shall be installed above finished ceilings. Where installed in exposed locations, labels shall be neatly located.
 - 3. Labels for horizontal joints shall be installed at a maximum spacing of ten (10) feet.

3.06 FIELD QUALITY CONTROL

- A. Prepare and install firestopping systems in accordance with manufacturer's shop drawings, tested assemblies and instructions
 - 1. Follow safety procedures recommended in Material Safety Data Sheets.
 - 2. Finish all firestopping surfaces that are to remain exposed in the completed Work to a uniform and level condition.
- B. Firestopping materials and installations at joints and penetrations in fire-resistive rated assemblies and smoke barrier assemblies shall not be concealed from view until inspected and approved by the Authority Having Jurisdiction or, if designated, by the Owner's testing agency. Such inspection shall include partial destructive inspection to determine compliance with tested firestop assembly requirements. All such locations shall be repaired or replaced by the Contractor at no additional cost to the Owner.

1. All firestopping locations shall be visually inspected.
 2. At a minimum, not less than 5% of all firestopping joints and penetrations shall be inspected by removal of materials to determine conformance to assembly requirements.
- C. Inspections by the AHJ and /or the testing agency shall not relieve the Contractor of responsibility for providing his own inspections and quality control in compliance with specified requirements.
- D. Inspections shall be performed as required by the Building Code, the Construction Documents or as otherwise directed by the Architect.
- E. The Contractor shall cooperate with individuals conducting such inspections. The Contractor shall notify inspectors at least five (5) days in advance of requested inspection date. All identification labeling, firestopping and smoke sealing work shall be completed prior to inspection.
- F. Any non-compliant materials shall be removed and replaced. Any locations missing required protection shall be corrected by the Contractor and re-inspected prior to concealing such areas with other construction. Any material or workmanship that is rejected shall be corrected and /or replaced promptly by the Contractor to the satisfaction of the inspector and/or Architect, and at no additional cost to the Owner.

3.07 PROTECTION

- A. Clean adjacent surfaces of firestopping materials. Leave work in a neat and clean condition.
- B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

**SECTION 07 90 05
JOINT SEALERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Spray-applied joint sealants.
- B. Nonsag gunnable joint sealants.
- C. Self-leveling pourable joint sealants.
- D. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 84 00 - Firestopping: Firestopping Sealants.
- B. Section 09 21 16 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
- C. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.03 REFERENCE STANDARDS

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015 (Reapproved 2022).
- B. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).
- C. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).
- D. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2022.
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- F. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.
- G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).
- H. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.
- I. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2022.
- J. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2023.
- K. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2019 (Reapproved 2020).
- L. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).
- M. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).
- N. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

1.04 REGULATORY REQUIREMENTS

- A. All products and materials must be approved for sale in and meet local, State, and Federal regulations.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
 - 1. Where the proposed sealant is proposed to be used (specific to this project).

2. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 3. List of backing materials approved for use with the specific product.
 4. Backing material recommended by sealant manufacturer.
 5. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 6. Substrates the product should not be used on.
 7. Substrates for which use of primer is required.
 8. Substrates for which laboratory adhesion and/or compatibility testing is required.
 9. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
 10. Sample product warranty.
 11. Certification by manufacturer indicating that product complies with specification requirements.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- D. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- E. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- F. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.
- G. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.
- H. Installation Plan: Submit at least four weeks prior to start of installation.
- I. Field Quality Control Plan: Submit at least two weeks prior to start of installation.
- J. Installation Log: Submit filled-out log for each length or instance of sealant installed.
- K. Field Quality Control Log: Submit filled-out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.
- L. Executed warranty.

1.06 QUALITY ASSURANCE

- A. Maintain one copy of each referenced document covering installation requirements on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum fifteen years experience.
- C. Installer Qualifications: Company specializing in performing the work of this Section with minimum five years experience. Where applicable, applicators shall be approved by their respective material manufacturers as licensed applicators. All applicators shall be skilled personnel who are thoroughly trained and experienced in the necessary skills, completely familiar with the specific requirements of the Work.
- D. Installation Plan: Include schedule of sealed joints, including the following:
1. Joint width indicated in Contract Documents.
 2. Joint depth indicated in Contract Documents; to face of backing material at centerline of joint.
 3. Method to be used to protect adjacent surfaces from sealant droppings and smears, with acknowledgment that some surfaces cannot be cleaned to like-new condition and therefore prevention is imperative.

4. Approximate date of installation, for evaluation of thermal movement influence.
5. Installation Log Form: Include the following data fields, with known information filled out.
 - a. Unique identification of each length or instance of sealant installed.
 - b. Location on project.
 - c. Substrates.
 - d. Sealant used.
 - e. Stated movement capability of sealant.
 - f. Primer to be used, or indicate no primer is used.
 - g. Size and actual backing material used.
 - h. Date of installation.
 - i. Name of installer.
 - j. Actual joint width; provide space to indicate maximum and minimum width.
 - k. Actual joint depth to face of backing material at centerline of joint.
 - l. Air temperature.
- E. Field Quality Control Plan:
 1. Visual inspection of entire length of sealant joints.
 2. Nondestructive field adhesion testing of sealant joints, except interior acrylic latex sealants.
 - a. For each different sealant and substrate combination, allow for one test every 12 inches in the first 10 linear feet of joint and one test every 24 inches thereafter.
 - b. If any failures occur in the first 10 linear feet, continue testing at 12 inches intervals at no extra cost to Owner.
 3. Field Quality Control Log Form: Show same data fields as on Preinstallation Field Adhesion Test Log, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified field testing; allow for possibility that more tests than minimum specified may be necessary.

1.07 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.
- B. Do not proceed with application of materials when surface or air temperatures are less than 40 degrees F or likely to drop to below 40 degrees F in the following 24 hours after sealant installation.
- C. Do not apply materials unless surface to receive coating is clean and dry, or if precipitation is imminent.
- D. Coordination: It shall be the responsibility of the Contractor to properly coordinate the Work of this Section with that of all other trades in order to ensure the providing of complete and continuous sealing and consistent use of products specified herein.

1.08 WARRANTY

- A. See Section 01 78 10 – Warranties: Close-out for additional warranty requirements.
- B. Warranties:
 1. Include coverage for installed sealants and accessories which fail to achieve airtight seal and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.
 - a. Urethane Sealants: Five years.
 - b. Silicone Sealants: Twenty years, unless otherwise indicated with product description.
 2. Provide manufacturer's non-stain warranty.
- C. The installer shall provide an installation warranty that all Sealing shall be free of defects of materials and workmanship for two (2) years; and shall repair and/or replace such defective work, during the warranty term, without extra cost to the Owner.

1. The following types of sealing failures will be considered defective Work: Leakage, loosening, loss of bond, hardening, cracking, crumbling, melting, shrinking, running, sagging, improper tooling, discoloration, or staining of adjacent work.

PART 2 PRODUCTS

2.01 JOINT SEALANTS - GENERAL

- A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.
- B. Definitions:
 1. Sealant Types:
 - a. M - Multi-component.
 - b. S- Single component.
 - c. P - Pourable or self-leveling for traffic joints
 - d. NS - Non-sage or gunnable for vertical and non-traffic joints.
 - e. FC - Fast cure.
 2. Sealant Classes:
 - a. 25, 50 and 100/50 (extension/compression) represent movement capability in percent of joint width.
 3. Sealant Uses:
 - a. T - Traffic
 - b. NT - Non-Traffic
 - c. I - Immersion
 - d. M - Mortar
 - e. A - Aluminum
 - f. O - Other (includes steel, painted surfaces, wood, brick, stone, tile)

2.02 NONSAG JOINT SEALANTS

- A. Interior Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
 1. Color: As selected from the manufacturer's full color range; at different material conditions.
 2. Applications: Sanitary
 - a. Joints between plumbing fixtures and floor and wall surfaces.
 - b. Joints between all countertops to splashes to wall surfaces.
 - c. Control, expansion, and corner joints within ceramic tile.
 - d. Joints between countertops and backsplashes when they are separate assemblies.
 3. Note: Compatibility with materials sealant shall be in contact with shall be verified prior to use.
 4. Limitations: Not for use at joints submerged in water, at porous materials like masonry, and as otherwise limited by the manufacturer.
 5. Products:
 - a. Pecora Corporation; Pecora 898 NST (Non-Staining Technology).
 - b. Tremco Commercial Sealants & Waterproofing; Tremsil 200.
 - c. Dow; Dowsil 786 .
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Interior Sealant, High Movement Head of Wall, Acoustical / Smoke Sealant - Acrylic Latex Sealant: ASTM C834; for use as acoustical and smoke resistant sealant for head-of-wall joints.
 1. Applications:
 - a. Smoke and acoustic sealant at high movement joints, including non-fire rated top of wall joints.
 2. Movement Capability: Plus and minus 50 percent, minimum.
 3. Color: White.

4. Acoustics: Provide system tested in accordance with ASTM E90 with STC rating of 50, minimum.
 5. Joint size: 1/4" min to 2" max width
 6. Note: Compatibility with materials sealant shall be in contact with shall be verified prior to use.
 7. Listed products are firestopping products, but do not require a listed assembly or labeling as specified in Section 07 84 00.
 8. See Section 07 84 00 - Firestopping for accessory mineral wool backing material.
 9. Products:
 - a. 3M; FireDam Spray 200.
 - b. STI; SpecSeal AS200 Elastomeric Spray.
 - c. Hilti, Inc.; CFS-SP WB Water-based acrylic sealant spray.
 - d. Substitutions: See Section 01 60 00-Product Requirements.
- C. General Purpose Interior Sealant, Low Movement - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, nonsagging; not intended for exterior use.
1. Color: To be selected by Architect from manufacturer's standard range.
 2. Grade: ASTM C834; Grade 0 Degrees F (Minus 18 Degrees C).
 3. Applications: For minimal movement.
 - a. Interior wall and ceiling control joints.
 - b. Joints between door and window frames and wall surfaces, where minimal movement is expected and will receive field painting.
 - c. Interior sound sealing, non-fire rated smoke sealing where little movement is anticipated.
 - d. Other interior joints for which no other type of sealant is indicated.
 4. Note: Compatibility with materials sealant shall be in contact with shall be verified prior to use.
 5. Limitations: Not for use at joints subject to dynamic movement, submerged in water, and as otherwise limited by the manufacturer.
 6. Products:
 - a. Hilti, Inc; Lightweight Smoke and Acoustic Sealant CS-S SA Light.
 - b. Pecora Corporation; AC-20 +Silicone.
 - c. Tremco Commercial Sealants & Waterproofing; Tremflex 834: .
 - d. Substitutions: See Section 01 60 00-Product Requirements.

2.03 SELF-LEVELING JOINT SEALANTS

- A. Interior Floor Joint Sealant: Two-component, 100 percent solids; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
1. Applications:
 - a. Cracks and construction joints in floors.
 2. Durometer Hardness, Type A: 75, minimum, after seven days when tested in accordance with ASTM D2240.
 3. Color: Concrete gray.
 4. Joint Width, Minimum: 1/8 inch.
 5. Joint Width, Maximum: 1/2 inch.
 6. Joint Depth: Provide product suitable for joints from 1/8 inch to 1 inch in depth excluding space for backer rod.
 7. Products:
 - a. ARDEX Engineered Cements; ARDEX ARDISEAL RAPID PLUS.
 - b. Mapei; Mapeiflex Joint Sealant PO 95/100.
 - c. SpecChem, LLC; Rapid Flex CJ.

- d. Substitutions: See Section 01 60 00-Product Requirements.

2.04 ACCESSORIES

- A. Sealant Backing Materials, General: Materials placed in joint before applying sealants; assists sealant performance and service life by developing optimum sealant profile and preventing three-sided adhesion; type and size recommended by sealant manufacturer for compatibility with sealant, substrate, and application.
- B. Sealant Backing Rod, Closed-Cell Type:
 - 1. Cylindrical flexible sealant backings complying with ASTM C1330 Type C.
 - 2. Size: 25 to 50 percent larger in diameter than joint width.
 - 3. Application: Exterior applications, unless otherwise noted.
- C. Sealant Backing Rod, Open-Cell Type:
 - 1. Cylindrical flexible sealant backings complying with ASTM C1330 Type O.
 - 2. Size: 25 to 50 percent larger in diameter than joint width.
 - 3. Application: Interior Applications.
- D. Compressible Filler: Compressible, open-cell polyurethane foam saturated with stabilizing acrylics, with a waterproof sealing compound/release agent. Size appropriately to fill void geometry, as recommended by the sealant manufacturer.
 - 1. Products:
 - a. Tremco, Willseal 600s.
 - b. Emseal; Backerseal.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- F. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- G. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- H. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.
- D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
 - 1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
 - 2. Notify Architect of date and time that tests will be performed, at least seven days in advance.
 - 3. Arrange for sealant manufacturer's technical representative to be present during tests.
 - 4. Record each test on Preinstallation Adhesion Test Log as indicated.
 - 5. If any sample fails, review products and installation procedures, consult manufacturer, or take other measures that are necessary to ensure adhesion; retest in a different location; if unable to obtain satisfactory adhesion, report to Architect.
 - 6. After completion of tests, remove remaining sample material and prepare joints for new sealant installation.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.

- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in an inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

- A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Provide joint sealant installations complying with ASTM C1193.
- C. Install acoustical sealant application work in accordance with ASTM C919.
- D. Sealing at Acoustical Construction: At construction designated "Acoustical Construction" seal around all joints and pipe, conduit, structural member, duct, and electrical box openings to gypsum wallboard or masonry as applicable. Seal bottom of gypsum wallboard partitions to floor slabs. Seal tops of masonry and gypsum wallboard partitions to decks (including voids at fluted decks), and seal sides of partitions to abutting construction. Note: Sealing related to installation of partition framing members and gypsum wallboard is specified under Section 09 21 16 - Gypsum Board Assemblies.
- E. Non-Fire Rated Smoke Sealing: At building assemblies identified as non-fire rated smoke partitions, seal all joints and pipe, conduit, structural member, duct and electrical box openings. Openings above finish ceilings or other concealed locations may be sealed on one side only. All openings and annular spaces shall be backed with fire safing insulation prior to installation of sealant.
- F. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- G. Install bond breaker backing tape where backer rod cannot be used.
- H. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- I. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- J. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
 - 1. Application of Sealant: Sealant shall be gun-applied through a nozzle opening of such diameter so that the full bead of sealant is gunned into the joint, filling the joint completely. A superficial or skin bead will not be acceptable.
 - a. Beads shall be tooled immediately after application to ensure firm, full contact with the inner faces of the joint. Excess material shall be struck off with a tooling stick or knife.
 - b. The finished bead shall be smooth, properly contoured and flush with the adjacent surface, or as otherwise indicated.
 - c. Remove all excess materials and smears adjacent to the joint as work progresses. All materials shall be used in accordance with the manufacturer's printed instructions.
- K. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.

- B. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.
- C. Repair destructive test location damage immediately after evaluation and recording of results.

END OF SECTION

SECTION 080671 – DOOR HARDWARE SCHEDULE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section references specification sections relating to commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Other doors to the extent indicated.
- B. Commercial door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
- C. Related Sections:
 - 1. Division 08 Section "Door Hardware".
 - 2. Division 08 Section "Automatic Door Operators".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. NFPA 70 - National Electrical Code.
 - 4. NFPA 80 - Fire Doors and Windows.
 - 5. NFPA 101 - Life Safety Code.
 - 6. NFPA 105 - Installation of Smoke Door Assemblies.
 - 7. State Building Codes, Local Amendments.
- E. Standards: Reference Related Sections for requirements regarding compliance with applicable industry standards.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.
- D. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.
- F. Warranties and Maintenance: Special warranties and maintenance agreements specified in the Related Sections.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.5 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

1.6 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. Refer to "PART 3 – EXECUTION" for required specification sections.

PART 3 - EXECUTION

3.1 DOOR HARDWARE SETS

- A. The door hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
 - 1. Quantities listed are for each pair of doors, or for each single door.
 - 2. The supplier is responsible for handing and sizing all products.

3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
 4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.
- B. Products listed in the hardware sets shall be supplied by and in accordance with the requirements described in the specification section as noted for each item.
1. Section 08 71 00 – Door Hardware.

Hardware Sets

Set: 1.0

- Replacement
1 Passage Lever Trim
1 Passage for Existing
Exit Device

Set: 2.0

- 1 Cylindrical Lockset,
Storeroom Function

Set: 3.0

- 1 Cylindrical Lockset,
Classroom Function
1 Cover Plate

Note: Remove existing deadbolt and replace with coverplate. Retain deadbolt for Owner's stock.

Set: 4.0

- 3 Hinge, Full Mortise,
Hvy Wt
1 Rim Exit Device,
Classroom
1 Surface Closer
1 Kick Plate
1 Wall Stop

Set: 5.0

-

- 3 Hinge, Full Mortise,
Hvy Wt
- 1 Fire Rated Rim Exit
Device, Classroom
- 1 Surface Closer
- 1 Kick Plate
- 1 Wall Stop
- 1 Gasketing

Set: 6.0

- 3 Hinge, Full Mortise,
Hvy Wt
- 1 Rim Exit Device,
Storeroom
- 1 Surface Closer
- 1 Kick Plate
- 1 Wall Stop
- 1 Gasketing

Set: 7.0

- 6 Hinge, Full Mortise,
Hvy Wt
- 1 Flush Bolt Set, Top
Only, Constant
Latching
- 1 Mortise Lockset,
Passage
- 2 Wall Stop
- 2 Silencer

Set: 8.0

- 3 Hinge, Full Mortise, Hvy
Wt
- 1 Mortise Lockset, Office
Function
- 1 Wall Stop
- 1 Automatic Door Bottom
- 1 Acoustic Seal Kit

Set: 9.0

- 3 Hinge, Full Mortise, Hvy
Wt
- 1 Mortise Lockset, Privacy
Function with Indicator
- 1 Wall Stop
- 3 Silencer

END OF SECTION 080671

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.
- C. Fire-rated hollow metal doors and frames.

1.02 RELATED REQUIREMENTS

- A. Section 08 71 00 - Door Hardware.
- B. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.
- C. Section 09 91 23 - Interior Painting: Field painting.
- D. Division 26 - Electrical: Access Control and Security system interface with doors and frames.
- E. Appendix B: DOC Standard Terms and Conditions (BABAA).
- F. Mechanical Drawings: Required door undercuts for ventilation.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2017.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2023.
- D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2020.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.
- F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2021a.
- G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2023.
- H. ASTM E413 - Classification for Rating Sound Insulation 2022.
- I. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames 2016.
- J. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- K. ITS (DIR) - Directory of Listed Products Current Edition.
- L. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames 2017.
- M. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames 2014.
- N. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.
- O. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives 2022.
- P. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.
- Q. UL (DIR) - Online Certifications Directory Current Edition.
- R. UL 10B - Standard for Fire Tests of Door Assemblies Current Edition, Including All Revisions.

- S. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.
- T. UL 1784 - Standard for Air Leakage Tests of Door Assemblies Current Edition, Including All Revisions.
- U. SDI 117: Manufacturing Tolerances for Standard Steel Doors and Frames.

1.04 REGULATORY REQUIREMENTS

- A. All products and materials must be approved for sale in and meet local, State, and Federal regulations.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, cores, sound ratings, profiles, anchorage and fastening methods, and finishes.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- D. Shop Drawings: Details of each opening, showing elevations, fire-ratings, glazing, frame profiles, anchors, and identifying location of different finishes, if any.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum ten years documented experience and a member of the Steel Door Institute.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
- C. Maintain at project site copies of reference standards relating to installation of products specified.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store in accordance with NAAMM HMMA 840. Store all materials upright, in a protected dry area, at least 1" or more off the ground or floor and at least 1/4" between individual pieces. Materials shall not be permitted to rust or corrode.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Steel Doors and Frames:
 - 1. Ceco Door, an Assa Abloy Group company.
 - 2. Curries, an Assa Abloy Group company.
 - 3. Republic Doors, an Allegion brand.
 - 4. Steelcraft, an Allegion brand.
- 5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
 - 1. Steel used for fabrication of doors and frames shall comply with one or more of the following requirements; Galvannealed steel conforming to ASTM A653, cold-rolled steel conforming to ASTM A1008, or hot-rolled pickled and oiled (HRPO) steel conforming to ASTM A1011, Commercial Steel (CS) Type B for each.

2. Accessibility: Comply with ICC A117.1 and ADA Standards.
 3. Door Top Closures: Welded, flush with top of faces and edges.
 4. Door Edge Profile: Manufacturers standard for application indicated.
 5. Typical Door Face Sheets: Flush.
 6. Glazed Lights: Non-removable stops on secure side; sizes and configurations as indicated on Drawings.
 - a. NOTE: Bottom of glazed lights must extend to within 43" of the floor and shall be at least 10" above the floor.
 7. Hardware Preparation: In accordance with DHI A115 Series, with reinforcement welded in place, in addition to other requirements specified in door grade standard.
 8. Galvanizing for Units in Wet Areas: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653, with manufacturer's standard coating thickness
 - a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.
- C. Fire-Rated Door Assemblies:
1. All fire-rated doors and frames shall conform to and/or be tested by the requirements of:
 - a. UL 10C - Pressure Fire Test of Door Assemblies.
 - b. NFPA 252 - Methods of Fire Tests of Door Assemblies.
 - 1) After 5 minutes in the test, the neutral pressure level in furnace shall be established at 40 inches or less above the sill.
 - c. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.
 - d. NFPA 101 - Life Safety Code, 2018.
 - e. International Building Code, 2018.
 - f. NFPA 105 - Standard for Installation of Smoke and Draft Control Assemblies.
 - g. ASTM E119 - Standard Method for Testing Construction Assemblies.
 - h. UL 1784: Smoke and draft control air leakage not to exceed 3.0 cu ft / min / sq ft of door opening at 0.10 inch of water for ambient and elevated temperature tests.
 2. All components of a fire-rated assembly (door, glazing, locks, closers, latches, lite frames, louvers, hinges, frames, etc.) shall be rated at or exceed the intended fire protection rating indicated for the assembly.
 3. Exit Enclosure Door Temperature Rise Rating: Max transmitted temperature of 450 degrees F. above ambient with 30 minutes of fire exposure, except for fully sprinkled buildings.
 4. Fire-rated doors and door frames shall be labeled in accordance with NFPA 80; permanently labeled and listed by UL, Intertek or Warnock Hersey.
 - a. Oversize fire-rated door assemblies: For door assemblies required to be fire-rated and exceeding sizes of tested assemblies, provide a certificate and label from an approved independent testing and inspection agency, indicating that the door and frame assembly conforms to the requirements of design, materials, and construction as established by individual listings for tested assemblies.
 - b. If any door or frame specified by the Architect to be fire-rated cannot qualify for appropriate labeling because of its design, hardware or any other reason, the Architect shall be so advised before proceeding with fabrication.

- D. Fire-Rated Window Assemblies: Comply with NFPA 80. Assemblies shall be identical to assemblies tested per NFPA 257 and shall be listed and labeled by UL, Intertek or Warnock Hersey.
- E. Fire-Rated Door, Door Frame and Window Assembly Ratings: As indicated on Door and Frame Schedule on the Drawings.
- F. All paired doors in smoke barriers in healthcare and ambulatory healthcare use groups shall have rabbets, bevels or astragals at meeting rails in compliance with NFPA 101.

2.03 HOLLOW METAL DOORS

- A. Door Finish: Factory primed and field finished, unless otherwise noted.
- B. General:
 - 1. Doors shall be strong, rigid and neat in appearance, free of warpage or buckle. Corner bends shall be true, straight, and of minimum radius for the gauge of metal specified.
 - 2. Tops and bottoms of the doors shall have an inverted channel made of 18-gauge galvanized steel; spot-welded five (5") inches on center to the door faces. Exterior doors shall receive an additional closed top made of 16-gauge galvanized steel, welded, ground smooth and dressed to seal the top of the door. Openings shall be provided in the bottom channel to permit the escape of entrapped moisture
- C. Interior Doors, Non-Fire-Rated:
 - 1. Grade: ANSI A250.8 - SDI-100; Level 2 - Heavy-Duty, Physical Performance Level B, Model 1 - Full Flush. (Level 2 - 18 gauge).
 - a. Exception: Grade for all doors in frame openings over 72" wide: Level 3, Physical Performance Level A, Model 2, full flush (Level 3 - 16 gauge).
 - 2. Core: Vertical steel stiffeners, minimum 20 gauge and 8 " apart, securely attached to both face sheets by spot welds not more than 4" on center. Provide sound deadening batt type mineral wool between each stiffener for the full length of the door.
 - 3. Door Thickness: 1-3/4 inches, nominal.
- D. Interior Doors, Fire-Rated:
 - 1. Grade: ANSI A250.8 - SDI-100; Level 2 - Heavy-Duty, Physical Performance Level B, Model 1 - Full Flush (Level 2 - 18 gauge).
 - a. Exception: Grade for all doors in frame openings over 72" wide: Level 3, Physical Performance Level A, Model 2, full flush (Level 3 - 16 gauge).
 - 2. Fire Ratings: As indicated on Door and Frame Schedule, tested in accordance with UL 10C ("positive pressure"). All fire-rated doors shall be smoke and draft control labeled.
 - a. Provide units listed and labeled by UL, WH, or other approved testing laboratory.
 - b. Attach fire rating label to each fire rated unit indicating hourly rating; including temperature rise rating and smoke / draft control "S" label if required.
 - 3. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
 - 4. Door Thickness: 1-3/4 inches, nominal.

2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Factory primed and field finished.
- C. General:
 - 1. Frames for Hollow Metal Doors:
 - a. ANSI A250.8 Level 2 Doors: 16 gauge frames.
 - b. ANSI A250.8 Level 3 Door Frames: 14 gauge, 0.067 inch, minimum thickness.
 - c. ANSI A250.8 Level 4 Doors: 14 gauge frames.

2. Frames for Wood Doors:
 - a. Interior Opening 42 inches and less: 16 gauge frames.
 - b. Interior Openings exceeding 42 inches wide: 14 gauge frames.
 - c. Exterior Openings: 14 gauge frames.
 3. Frames Wider than 48 Inches: Reinforce with steel channel, minimum 12 gauge, factory welded to the frame head, flush with top. Such stiffeners shall not be used as lintels or load-carrying members.
- D. Interior Door Frames:
1. Faced Welded: All door frames, less than 42", unless otherwise indicated.
- E. Interior Frames for Glazing (Borrowed Lites): Construction and face dimensions to match door frames, and as indicated on Drawings.
- F. Corner joints shall be die mitered and have all contact edges closed tight and continuously welded.
- G. Frame, trim and profiles shall be as scheduled by the Architect and verified by the Contractor. All frame depths shall be coordinated with partition type depths by the Contractor. Frames for drywall partitions shall have 1/2 inch backbends with hooked profile.
- H. Minimum depth of stops shall be 5/8". Use 3/4" only where required for fire rating or security.
- I. When shipping limitations so dictate, frames for large openings shall be fabricated in sections designed for splicing in the field. All splicing locations and details shall be clearly identified on shop drawings.
- J. Frames for multiple or special openings shall have mullion and/or rail members that are closed tubular shapes having no visible seams or joints. All joints between faces of abutting members shall be securely welded and finished smooth.
- K. Frames shall be provided with supplemental internal concealed steel reinforcement, as engineered by the manufacturer.
- L. Floor Anchors: Securely weld anchors inside each jamb, with 2 holes provided at each jamb for floor anchorage. Where required adjustable floor anchors, providing not less than 2" height adjustment, shall be provided. Minimum thickness of floor anchors shall be 14 gage, zinc coated per ASTM A591.
- M. Stud Partition Jamb Anchors: Shall be steel anchors, compatible with the actual stud used, minimum 18 gauge thickness, zinc coated per ASTM A-591 Provide 4 anchors for frames up to 7'-6" high, 5 anchors for frames up to 8'-0" high and 1 additional anchor for each 2'-0" of height over 8'-0".

2.05 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
- B. After fabrication, all tool marks and surface imperfections shall be dressed, permanently filled and sanded as required to make all faces and vertical edges smooth, level and free of all irregularities. Doors shall be primed to ensure maximum paint adhesion, on all exposed surfaces with a rust-inhibitive primer in accordance with ANSI A250 - Test Procedure and Acceptance Criteria for Primed Painted Steel Surfaces.

2.06 ACCESSORIES

- A. Glazing: As specified in Section 08 80 00.
- B. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
- C. Fixed Stops: Custom full-flush with no apparent seams on the face of the door at the outside of spaces to be secured.
- D. Temporary Frame Spreaders: Provide for all factory or shop-assembled frames.

- E. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. The Contractor shall take all measurements, make all investigations, and in general, provide field work and coordination as required to ensure the proper fit of all Work specified herein. Frames shall be sized, positioned, and installed in accordance with the design intent represented on the Drawings. The design intent shall not be modified due to the Contractor's failure to provide coordination or obtain properly fabricated materials. Such coordination shall be provided sufficiently in advance so as to avoid delays in the construction schedule.
- B. Verify that opening sizes and tolerances are acceptable. It shall be the responsibility of the Contractor to coordinate frame thicknesses with each wall and partition type to ensure proper fit.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Install fire-rated units in accordance with NFPA 80 and ASTM E119.
- C. Coordinate frame anchor placement with wall construction. Wherever possible, leave frame spreader bars intact until frames are set perfectly square and plumb, and anchors are securely attached. Verify that frames are square and plumb following removal of temporary spreaders.
- D. Coordinate installation of hardware in accordance with hardware manufacturer's templates and instructions. Doors and frames fabricated with hardware cutouts and reinforcing which will not properly accommodate finish hardware shall be rejected and replaced at no additional cost to the Owner.
- E. Comply with glazing installation requirements of Section 08 80 00.
- F. Coordinate installation of electrical connections to electrical hardware items.
- G. Immediately after erection, areas where prime coat or galvanizing has been damaged shall be sanded smooth and touch up with same primer or zinc rich rust-inhibitor primer as applied at the factory. Remove rust before touch-up is applied.

3.03 TOLERANCES

- A. Clearances Between Door and Frame:
 - 1. Between steel doors and frame, at head and jambs: 1/8", with maximum 1/16" +/- variation.
 - 2. Between wood doors and frame, at head and jambs: 1/8" maximum.
 - 3. Between meeting edges of pairs of doors: 1/8" maximum.
 - 4. Between face of door and stop: 1/8".
 - 5. Door Undercuts:
 - a. At door bottoms: 3/4" maximum
 - b. At smoke-rated door bottoms: 3/8" maximum.
 - c. Note: Door sills, except at fire-rated doors, may be undercut greater than the clearances indicated above as indicated in the Mechanical Drawings.
 - 6. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.04 ADJUSTING

- A. Adjust for smooth and balanced door movement.

- B. Protect installed doors, frames and accessories against damage from other construction work. Any damage prior to acceptance shall be repaired or replaced, if such action complies with the requirements and shows no evidence of repair or refinishing.

3.05 SCHEDULE

- A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 08 31 00
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall and ceiling access door and frame units.
- B. It is not intended that the Drawings or Specifications identify specific access door sizes or locations. Subcontractors whose work requires access panels in wall, floor, and ceiling assemblies shall thoroughly examine all Contract Documents and provide suitable access to all equipment, hardware, accessories and all other items that may require adjustment, observation or maintenance. Note: Access doors located in mechanical equipment or ductwork are provided as part of the work of Division 23 - HVAC.

1.02 RELATED REQUIREMENTS

- A. Section 09 21 16 - Gypsum Board Assemblies: Openings in partitions and ceilings.
- B. Section 09 91 23 – Interior Painting and Coating: Field paint finish.
- C. Division 22 - Plumbing
- D. Division 23 - HVAC
- E. Division 26 – Electrical
- F. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.03 REFERENCE STANDARDS

- A. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021a.
- B. ASTM A1008 - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2021a.
- C. ASTM A1011 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.
- D. ITS - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.
- E. UL - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.04 REGULATORY REQUIREMENTS

- A. All products and materials must be approved for sale in and meet local, State, and Federal regulations.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide materials, construction, profiles, types, finishes, hardware, locking provisions, and details of adjoining work.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- D. Shop Drawings: Indicate exact position of all access door units.
- E. Project Record Documents: Record actual locations of all access units.

1.06 WARRANTY

- A. See Section 01 78 10 - Warranties, for term and other warranty requirements.

PART 2 PRODUCTS

2.01 WALL AND CEILING UNITS

- A. Manufacturers, Basis of Design
 - 1. Acudor Products, Inc.
 - 2. Other Acceptable Substitutions:
 - a. Nystrom Products.
 - b. Larsens Manufacturing Co.
 - c. Karp Associated, Inc.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Applications:
 - 1. Gypsum board substrates:
 - a. Non-Fire Rated; Basis of Design: DW-5040 Series by ACUDOR.
 - b. Fire Rated; Basis of Design: FB-5060-DW Series by ACUDOR.
 - 2. Masonry substrates:
 - a. Non-Fire Rated; Basis of Design: UF-5500 Series by ACUDOR.
 - b. Fire Rated; Basis of Design: FB-5060 Series by ACUDOR.
 - 3. Tile substrates:
 - a. Non-Fire Rated; Basis of Design: DW-5058-TD Series by ACUDOR.
 - b. Fire Rated; Basis of Design: FB-5060-TD Series by ACUDOR.
- C. Access Doors: Factory fabricated door and frame units, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies units are to be installed in.
 - 1. Material: Steel.
 - 2. Frames: 16 gauge, 0.0598 inch, minimum.
 - 3. Single Thickness Steel Door Panels: 0.070 inch, minimum.
 - 4. Double-Skinned Hollow Steel Door Panels: 16 gauge, 0.059 inch, minimum, on both sides and all edges.
 - 5. Units in Fire Rated Assemblies: Fire rating as required by applicable code for the fire rated assembly that access doors are being installed.
 - a. Provide products listed and labeled by UL or ITS (Warnock Hersey) as suitable for the purpose specified and indicated (labeled for horizontal or vertical installation).
 - 6. Steel Finish: Factory prime painted for field finish painting.
 - 7. Sizes: As required for each condition, minimum size 8" x 8" for access to items; such as valves. A minimum of 24" x 48" for access by workers, and where equipment may need to be removed and replaced. Condition is defined as allowing ample space for access to items that require maintenance and replacement, a worker has to be allowed access with tools and to remove and replace items being accessed.
 - a. Contractor to note all locations and sizes on Coordination Drawings.
 - 8. Hardware:
 - a. Hardware for Fire Rated Units: As required for listing.
 - b. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
 - c. Latch/Lock: Cylinder lock operated cam latch, two keys for each unit.
 - d. Inside Latch Release: For all doors intended to allow a person to fully pass through, provide Mechanism that allows the panel to be opened from the inside without the use of a tool or key
 - e. Horizontal Applications: Equip with restraints to prevent doors from falling open or closed upon release. All doors greater in size than 300 square inches and installed horizontally shall be provided with the following sign in 1/2" high red letters adjacent to the door lock: "Caution: Door will drop upon lock release".

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings are correctly sized and located.

- B. Door locations that may physically or visually conflict with adjacent construction or building features shall be brought to the attention of the Architect prior to 'roughing-in'. Doors installed in locations objectionable to the Architect shall be removed, patched, and relocated at no additional cost to the Owner.

3.02 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings. Secure rigidly in place.
- C. Position units to provide convenient access to the concealed work requiring access.
- D. Adjust hardware and panels after installation for proper operation.
- E. Door lock keys shall be labeled and turned over to the Owner per Project Close-out requirements. All doors shall operate off a Master Key system.

END OF SECTION

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 08 Section "Hollow Metal Doors and Frames".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. NFPA 70 - National Electrical Code.
 - 4. NFPA 80 - Fire Doors and Windows.
 - 5. NFPA 101 - Life Safety Code.
 - 6. NFPA 105 - Installation of Smoke Door Assemblies.
 - 7. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
 - 1. ANSI/BHMA Certified Product Standards - A156 Series.
 - 2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
 - 3. ANSI/UL 294 - Access Control System Units.
 - 4. UL 305 - Panic Hardware.
 - 5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 - 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- D. Informational Submittals:
 - 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
 - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.
- G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 - 1. Function of building, purpose of each area and degree of security required.
 - 2. Plans for existing and future key system expansion.
 - 3. Requirements for key control storage and software.
 - 4. Installation of permanent keys, cylinder cores and software.
 - 5. Address and requirements for delivery of keys.
- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
 - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors.

- Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 3. Review sequence of operation narratives for each unique access controlled opening.
 4. Review and finalize construction schedule and verify availability of materials.
 5. Review the required inspecting, testing, commissioning, and demonstration procedures
- I. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 1. Structural failures including excessive deflection, cracking, or breakage.
 2. Faulty operation of the hardware.
 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, function, and other distinctive qualities of each type of door hardware are indicated in Section 08 06 71 – Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 BUTT HINGES

- A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
 - 1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 - 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
 - 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
 - 4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
 - 5. Manufacturers:
 - a. McKinney - TA Series, 3-knuckle.

- b. Ives – 5BB Series

2.3 CONTINUOUS HINGES

- A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
 - 1. Where specified, provide modular continuous geared hinges that ship in two or three pieces and form a single continuous hinge upon installation.
 - 2. Manufacturers:
 - a. Pemko.
 - b. Roton.
 - c. Ives

2.4 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.
 - 1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
 - 2. Furnish dust proof strikes for bottom bolts.
 - 3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
 - 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
 - 5. Manufacturers:
 - a. Rockwood 2805
 - b. Ives FB51T
- B. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
 - 1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
 - 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
 - 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
 - 4. Pulls, where applicable, shall be provided with a 10" clearance from the finished floor on the push side to accommodate wheelchair accessibility.
 - 5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
 - 6. Manufacturers:

- a. Rockwood.
- b. Ives.

2.5 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Requirements:
 - 1. Provide cylinders/cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.
 - 2. Manufacturer: to be verified with Owner.
- C. Keying System: Each type of lock and cylinders to be factory keyed.
 - 1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
 - 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 - 3. Existing System: Key locks to existing key system as directed by the Owner.
- D. Key Quantity: Provide the following minimum number of keys:
 - 1. Change Keys per Cylinder: Three (3).
 - 2. Master Keys (per Master Key Level/Group): Five (5).
 - 3. Construction Keys (where required): Ten (10).
 - 4. Construction Control Keys (where required): Two (2).
 - 5. Permanent Control Keys (where required): Two (2).
- E. Construction Keying: Provide temporary keyed construction cores.
- F. Key Registration List (Bitting List):
 - 1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
 - 2. Provide transcript list in writing or electronic file as directed by the Owner.

2.6 KEY CONTROL

- A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.
 - 1. Manufacturers:
 - a. Lund Equipment (LU).
 - b. MMF Industries (MM).
 - c. Telkee (TK).

2.7 CYLINDRICAL LOCKS AND LATCHING DEVICES

- A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed cylindrical locksets. Listed manufacturers shall meet all functions and features as specified herein.
1. Lock Trim Design: Corbin Russwin NZ, or equal
 2. Manufacturers:
 - a. Corbin Russwin Hardware - CLX3300 Series. (Basis of Design)
 - b. Sargent Manufacturing - 10X Line.
 - c. Schlage – ND-Series.

2.8 MORTISE LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.
1. Lock Trim Design: Corbin Russwin LW, or equal
 2. Manufacturers:
 - a. Corbin Russwin Hardware - ML2000 Series.
 - b. Sargent Manufacturing - 8200 Series.
 - c. Schlage - L9000 Series.

2.9 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards: Comply with the following:
1. Strikes for Mortise Locks and Latches: BHMA A156.13.
 2. Strikes for Bored Locks and Latches: BHMA A156.2.
 3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
 4. Dustproof Strikes: BHMA A156.16.

2.10 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
1. Exit devices shall have a five-year warranty.
 2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
 3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
 4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
 5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
 6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: To match existing building.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
 7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
 8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.
1. Manufacturers:
 - a. Von Duprin - 98 Series.
 - b. Sargent Manufacturing (SA) - 80 Series.
 - c. Stanley – Apex Series.

2.11 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
 4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Large Body Cast Iron): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.
1. Large body cast iron surface mounted door closers shall have a 30-year warranty.
 2. Manufacturers:
 - a. Corbin Russwin Hardware - DC8000 Series.
 - b. Norton Rixson - 9500 Series.
 - c. LCN 4040XP series

2.12 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:
 - a. Rockwood.
 - b. Ives.

2.13 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 1. Manufacturers:
 - a. Rockwood.
 - b. Ives.

2.14 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:

1. Pemko
2. Zero International.

2.15 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.16 FINISHES

- A. FINISH: BHMA 626/652 (US26D); EXCEPT:EXECUTION

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Aluminum Geared Continuous Hinges: BHMA 628 (US28)
3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
4. Protection Plates: BHMA 630 (US32D)
5. Overhead Stops and Holders: BHMA 630 (US32D)
6. Door Closers: Powder Coat to Match
7. Wall Stops: BHMA 630 (US32D)
8. Latch Protectors: BHMA 630 (US32D)
9. Weatherstripping: Clear Anodized Aluminum
10. Thresholds: Mill Finish Aluminum

2.17 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

2.18 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

2.19 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

2.20 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 - 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

2.21 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

2.22 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

2.23 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

2.24 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
 - 1. Quantities listed are for each pair of doors, or for each single door.
 - 2. The supplier is responsible for handing and sizing all products.
 - 3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
 - 4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.
- B. Refer to Section 080671, Door Hardware Sets, for hardware sets.

END OF SECTION 087100

**SECTION 08 80 00
GLAZING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Monolithic glass units.
- B. Two-way mirror glass units.
- C. Plastic Films.
- D. Glazing compounds.

1.02 RELATED REQUIREMENTS

- A. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
- B. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials Current Edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test 2015 (Reaffirmed 2020).
- C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers 2005 (Reapproved 2019).
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- E. ASTM C1036 - Standard Specification for Flat Glass 2021.
- F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.
- G. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016 (Reapproved 2023).
- H. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings 2016.
- I. GANA (GM) - GANA Glazing Manual 2022.
- J. GANA (SM) - GANA Sealant Manual 2008.
- K. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having
- L. ITS (DIR) - Directory of Listed Products; Current Edition.
- M. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.
- N. NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies; 2022.
- O. UL (DIR) - Online Certifications Directory; Current Edition.
- P. UL 9 - Standard for Fire Tests of Window Assemblies; Current Edition, Including All Revisions.
- Q. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- R. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meeting: Convene a pre-installation meeting at least two weeks before starting work of this Section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data on Insulating Glass Unit, Glazing Unit, and Plastic Film Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- E. Shop Drawings: Submit glazing schedule indicating all openings to be glazed and type of glazing.
 - 1. Submit structural analysis and certification sealed and signed by a qualified professional structural engineer, licensed in the State of Rhode Island, that glazing panels specified to meet load requirements for guards comply with applicable code, where indicated for the specific glazing type.
- F. Samples: Submit samples 8 by 8 inches in size of glass and plastic units, showing coloration and design.
- G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA (GM), GANA (LGRM), GANA (SM), IGMA TM-3000, GANA (GM), GANA (LGRM), GANA (SM), IGMA TM-3000, GANA (GM), GANA (LGRM), GANA (SM), IGMA TM-3000, GANA (GM), GANA (LGRM), GANA (SM), and IGMA TM-3000 for glazing installation methods. Maintain one copy on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum three years of documented experience.
 - 1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
 - a. Insulating Glass Certification Council (IGCC).
 - b. Safety Glazing Certification Council (SGCC).
- C. Installer Qualifications: Company specializing in performing the work of this Section with minimum five years documented experience.
- D. All heat strengthened, tempered and laminated glass shall be permanently labeled by such means as etching, sandblasting, firing of ceramic materials on the glass, or by other suitable means so as to be easily visible and legible. The label shall identify the nominal thickness, glass type and compliance with requirements of ANSI Z97.1 and with a certification label of the Safety Glazing Certification Council (SGCC) or other certifying agency acceptable to the Authority Having Jurisdiction.
 - 1. Fire-protection-rated glazing shall be permanently labeled per IBC requirements with name of manufacturer, test standard and rating identification.

1.07 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 50 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 WARRANTY

- A. See Section 01 78 10 - Warranties-out for additional warranty requirements.
- B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.

1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
3. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
4. Impact Resistant Safety Glass: Complies with ANSI Z97.1 - Class A, or 16 CFR 1201 - Category II criteria.
5. Glass and Coatings Manufacturer (Basis of Design):
 - a. Guardian Industries Corp.
 - b. AGC Glass Company North America, Inc.
 - c. Acceptable Substitute Manufacturers:
 - 1) Cardinal Glass Industries.
 - 2) Pilkington North America Inc.
 - 3) Vitro Architectural Glass.
 - 4) Other Manufacturers listed in this Section.
 - 5) Substitutions: See Section 01 60 00 - Product Requirements.

2.02 GLAZING UNITS

- A. Type S-1 - Monolithic Safety Glazing: Non-fire-rated.
 1. Applications:
 - a. Glazed lites in interior doors, except fire doors.
 - b. Glazed interior sidelights to doors, except in fire-rated walls and partitions.
 - c. Other locations required by applicable federal, state, and local codes and regulations.
 - d. Other locations indicated on drawings with the S-1 designation.
 2. Glass Type: Fully tempered safety glass as specified.
 3. Safety Glazing Requirements: Complies with ANSI Z97.1 - Class A, or 16 CFR 1201 - Category II criteria.
 4. Exposed Edge Finish: Flat polished with eased edges.
 5. Tint: Clear.
 6. Minimum Thickness; size to fit application and load requirement:
 - a. Glazing with all sides within frame and width or height less than 42 inches: 1/4 inch, nominal.
 - b. Glazing with all sides within frame and width or height greater than 42 inches, but less than 60 inches: 3/8 inch, nominal.
 - c. Glazing with any exposed edges with a width or height up to 60 inches: 1/2 inch, nominal.
- B. Type S-2 - Fire-Protection-Rated Glazing: Type, thickness, and configuration of glazing that contains flame, smoke, as required to achieve indicated fire rating period indicated on Door Schedule.
 1. Applications:
 - a. Glazing in fire-protective-rated door assemblies in exit stair enclosures.
 - b. Other locations as indicated on drawings.
 2. Provide products listed by ITS (DIR) or UL (DIR) and approved by authorities having jurisdiction.
 3. Safety Glazing Certification: 16 CFR 1201 Category II.
 4. Glazing Method: As required for fire rating.
 5. Markings for Fire-Protection-Rated Glazing Assemblies: Provide permanent markings on fire-protection-rated glazing in compliance with ICC (IBC), local building code, and authorities having jurisdiction
 - a. "D" - meets fire door assembly criteria of NFPA 252, UL 10B, or UL 10C fire test standards.
 - b. "H" - meets fire door assembly hose stream test of NFPA 252, UL 10B, or UL 10C fire tests standards.

- c. "XXX" - placeholder that represents fire-rating period, in minutes.
- 6. Fire-Rating Designation: D-H-60.
 - a. Applications:
 - 1) Glazing in fire-protective-rated door assemblies in exit stair enclosures.
 - 2) Other locations as indicated on drawings.
 - b. Products:
 - 1) SAFTIFIRST, a division of O'Keeffe's Inc; SuperLite X-45/60/90.
 - 2) Technical Glass Products; Firelite Plus, Premium surface.
 - 3) Substitutions: See Section 01 60 00 - Product Requirements.
- C. Type S-4 - Two-Way (Transparent) Mirror Glass: Mirror quality float glass, Type 1 Class 1, quality Q3, with pyrolite metal oxide factory coating applied to one face to create a reflective, silver gray appearance. Fully tempered where required for safety or where indicated on the Drawings.
 - 1. Applications: Locations as indicated on drawings.
 - 2. Thickness: 1/4 inch.
 - 3. Glass Tint: Grey.
 - 4. Glass Type: Annealed.
 - 5. Lighting Ratio: Maintain at least 8:1 lighting level ratio between coated side (bright-observed side) and uncoated side (dim-observer side).
 - 6. Glazing Method: Gasket glazing.
 - 7. Confirm subject side with Architect prior to installation.
 - 8. accordance with ASTM E84 (Flame Spread 0-25, Smoke Developed Index 0-450).
 - 9. Products:
 - a. LLumar; SCL SR PS4 Safety-and-Security Film.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 GLAZING FILMS

- A. Glazing Film Type F-1: Safety/security plastic film for application on glass.
 - 1. Impact Resistance: Provide films that when applied to 1/8-inch or 1/4-inch annealed glass, pass the impact test requirements of ANSI Z97.1 / CPSC 16 CFR 1201
 - 2. Surface Burning Characteristics: Provide films that have a Class A rating when tested in accordance with ASTM E84 (Flame Spread 0-25, Smoke Developed Index 0-450).
 - 3. Products:
 - a. LLumar; SCL SR PS4 Safety-and-Security Film.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 ACCESSORIES

- A. Glazing Materials: Select glazing compounds, sealants, tapes, gaskets and additional glazing materials of proven compatibility with other materials they will contact, including glass products, seals of insulating glass units and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.
- B. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.
- C. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.02 PREPARATION

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- C. Install glazing in hollow metal frames, steel doors, and flush doors using wet method; clear silicone sealant at non-fire-rated frames and doors, sealant approved for fire rated assemblies at fire rated frames and doors.
- D. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- E. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, and paint.

3.04 CLEANING

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove nonpermanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.05 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 09 05 61
COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preparation of new concrete floor slabs for installation of floor coverings upon results of testing.
- B. Testing of concrete floor slabs for moisture and pH.

1.02 RELATED REQUIREMENTS

- A. Section 01 23 00 – Alternates
- B. Section 01 40 00 - Quality Requirements.
- C. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds and finish for concrete slabs to receive finish flooring.
- D. Section 03 54 00 – Cast Underlayment: Cementitious leveling and feather underlayment.
- E. Section 09 65 00 - Resilient Flooring.
- F. Section 09 68 13 – Tile Carpeting.
- G. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.03 REFERENCES

- A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
- B. ASTM F1869 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.
- C. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.
- D. RFCI - Recommended Work Practices for Removal of Resilient Floor Coverings; 2018.

1.04 REGULATORY REQUIREMENTS

- A. All products and materials must be approved for sale in and meet local, State, and Federal regulations.

1.05 SUBMITTALS

- A. Product Data: Floor covering and adhesive manufacturers' product data for each specific combination of substrate, floor covering, and adhesive to be used, submit:
 - 1. Manufacturer's recommended slab moisture and pH limits.
 - 2. Manufacturer's required bond/compatibility test procedure.
- B. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- C. Field Reports:
 - 1. submit visual observation report for existing floor coverings to be removed.
 - 2. Submit contractor's field adhesive bond and compatibility test results.

1.06 QUALITY ASSURANCE

- A. Moisture and pH testing shall be performed by an independent testing agency employed and paid for by Owner.
- B. Contractor may perform adhesive and bond test with his own personnel or hire a testing agency.
- C. Contractor's Responsibility Relating to Independent Agency Testing:
 - 1. Provide access for and cooperate with testing agency.

2. Confirm date of start of testing at least 10 days prior to actual start.
 3. Allow at least 4 business days on site for testing agency activities.
 4. Achieve and maintain specified ambient conditions.
 5. Notify Owner when specified ambient conditions have been achieved and when testing will start.
- D. Applicator Qualifications: Companies specializing in performing the work of this Section with minimum five years of experience and approved by the manufacturer.

1.07 PRE-INSTALLATION MEETING

- A. Convene a pre-installation meeting after the results of slab testing are available and at least two weeks before starting finish flooring installation; require attendance by the Contractor, a technical representative from each flooring manufacturer, flooring installer, Architect and Owner, to review slab moisture levels, floor surface conditions and preparation requirements, materials, installation procedures and coordination of related work.
- B. NOTE: The same flooring manufacturers who reviewed and accepted the concrete floor finish shall attend this meeting.
1. A field report summarizing the findings and recommendations from this meeting shall be issued by the technical representatives and copied to the Owner and Architect.
 2. Written certification from each flooring manufacturer that condition of sub-floor is acceptable for flooring installation shall be issued and copied to the Owner and Architect.
 3. If a slab moisture sealer or other remedial work is required to make the condition of the sub-floor acceptable for the flooring installation, such measures shall be reviewed with the manufacturer's technical representatives and the Contractor shall be instructed to procure pricing.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
- B. Deliver materials in manufacturer's packaging; include installation instructions.
- C. Keep materials from freezing.

1.09 FIELD CONDITIONS

- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.
- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.01 WORK SCOPE:

- A. Provide Slab Moisture Barrier System for all slabs on grade.
- B. See Section 01 23 00 – Alternates for Slab Moisture Barrier System at concrete slabs-on-grade and concrete on metal decks.

2.02 MATERIALS

- A. Patching Compounds: Cementitious type recommended by adhesive material manufacturer and flooring manufacturer. Calcium sulphate, plaster or gypsum based toppings, leveling and patching compounds are not acceptable.
1. Product:
 - a. Ardex; K-15 (Slope / Build-up Product: SD-P).
 - b. Laticrete; Drytek Premium Skimcoat Patch Underlayment with Primer.
 - c. Uzin; NC 170 Leveling Compound.
 - d. Substitutions: See Section 01 60 00 – Product Requirements.

- B. Self-Leveling Cementitious Underlayment: See Section 03 54 00.
- C. Slab Moisture Barrier System: Epoxy slab coating for moisture vapor remediation and primer coat. VOC regulation compliant; Low odor; VOC content <10 g/l.
 - 1. Substrate preparation and conditions shall be reviewed and confirmed with the manufacturer's technical representative prior to installation.
 - 2. Must comply with ASTM F3010.
 - 3. Products:
 - a. Koster; VAP I 2000 coating with VAP I 06 primer.
 - b. Chapco, a division of H.B. Fuller; Defender coating, with MP Primer.
 - c. General Polymers, a division of Sherwin Williams; AquArmor MCS
 - d. Uzin; PE 460 Moisture Vapor Retarder with PE 280 Primer and NC 170 Leveling Compound

PART 3 EXECUTION

3.01 EXAMINATION AND FIELD TESTING

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Concrete Floor Surfaces: Verify that substrate conforms to ASTM F710.
 - 1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
 - 2. Conduct adhesive bond tests.
 - 3. Conduct water absorption tests.
- C. Owner's testing agency shall test concrete slab surfaces prior to installation of any flooring. Test results shall be made available to the contractor for determination of acceptability by the flooring and adhesives manufacturers. Contractor shall obtain instructions from flooring manufacturers if test results are not within their recommendation limits. Testing shall include:
 - 1. Internal relative humidity rates per ASTM F2170
 - 2. Moisture vapor emission rates per ASTM F1869.
 - 3. Alkalinity, pH rates per ASTM 710.
 - 4. Adhesive bond tests.
 - 5. Water absorption tests.
- D. Testing Agency's Report: Include:
 - 1. Description of areas tested; include floor plans and photographs if helpful.
 - 2. Summary of conditions encountered.
 - 3. Moisture and pH test reports.
 - 4. Copies of specified test methods.
 - 5. Recommendations for remediation of unsatisfactory surfaces.
 - 6. Include certification of accuracy by authorized official of testing agency.
 - 7. Submit report directly to Owner not more than two business days after conclusion of testing.
- E. If remedial work is recommended by the flooring and adhesive manufacturers, the preparation for and installation of moisture control coatings shall be inspected by the product manufacturer's technical representative and tested for adequacy by the Owner's testing agency prior to resumption of the flooring installation.
- F. Any conditions that could adversely affect the flooring installation shall be corrected, prior to proceeding with the Work. Commencement of the installation of flooring shall be considered acceptance of the concrete slab as being suitable for the intended application. Any conditions that could adversely affect the flooring installation shall be brought to the Contractor's attention, for resolution, prior to proceeding with the Work.

3.02 CONCRETE SLAB PREPARATION

- A. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.
 - 1. Surface preparation for and installation of moisture control coatings shall be inspected by the product manufacturer's technical representative and tested for adequacy by the Owner's testing agency prior to resumption of the flooring installation.
 - 2. Determination shall be made whether slab surface is required to be roughened by shot blast treatment prior to installation of moisture barrier system.
 - 3. Install self-leveling underlayment if required for adhesion of flooring adhesive over moisture barrier.
- B. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor patching compound to achieve smooth, flat, hard surface. Provide transition strips directly over construction joints between floor slabs where applicable.
- C. Resilient flooring shall not be installed over floors that have been treated with chemical compounds. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by the manufacturer. Do not use solvents.
- D. Installation of patching compounds:
 - 1. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities.
 - 2. Subfloor surfaces shall not vary more than plus or minus 1/8" in any 10' dimension. Neither shall they vary at a rate greater than 1/16" per running foot. Leveling compound shall be used for larger areas. Prohibit traffic until patching and sloping compounds are cured.
- E. All flooring surface transitions shall be as smooth and level as possible. Carpet and resilient flooring shall be laid flush with all adjacent flooring materials. Fill edge of subfloor adjacent to higher flooring with approved crack and leveling filler as required to provide a smooth transition. Filler shall be feathered back to subfloor a minimum of one foot for each 1/16" of thickness.
- F. Any room with a floor drain shall slope to the drain at between 1% and 2% slope. All areas within 8' of the floor drain shall slope to drain (or entire room if room is smaller than the 8' radius allows), or as drawings otherwise indicate. At door and partition locations – the floor shall be set to the floor level (with the drain being lower than the floor level).

3.03 PRELIMINARY CLEANING

- A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.
- B. Do not use solvents or other chemicals for cleaning.

3.04 PREPARATION

- A. See individual floor covering Sections for additional requirements.
- B. Comply with requirements and recommendations of floor covering manufacturer.
- C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
- D. Do not fill expansion joints, isolation joints, or other moving joints.

3.05 PROTECTION

- A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Interior metal stud wall framing.
- C. Metal channel ceiling and soffit framing.
- D. Acoustic construction, including installation of acoustic insulation and sealing of joints at framing and gypsum board.
- E. Gypsum wallboard products.
- F. Abuse-resistant gypsum wallboard products.
- G. Horizontal and vertical shaftwall systems.
- H. Marking and identification of fire-rated assemblies.
- I. Joint treatment, expansion and control joints, special shapes and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 54 - Wood Blocking and Curbing: Wood blocking for support of wall-mounted equipment.
- B. Section 07 21 00 - Thermal Insulation: Acoustic insulation.
- C. Section 07 84 00 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.
- D. Section 07 90 05 - Joint Sealants: Sealants.
- E. Section 09 30 00 - Tiling: Tile backer board.
- F. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.03 REFERENCE STANDARDS

- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members 2016, with Supplement (2020).
- B. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing 2020.
- C. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing 2015, with Errata (2020).
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- E. ANSI S220 - North American Standard for Cold-Formed Steel Framing Nonstructural Members - General Provisions.
- F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.
- G. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members 2015.
- H. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products; 2020.
- I. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2017 (Reapproved 2022).
- J. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2020.
- K. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2020.

- L. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness 2022.
- M. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs 2022.
- N. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base 2019.
- O. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.
- P. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.
- Q. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).
- R. ASTM E413 - Classification for Rating Sound Insulation 2022.
- S. GA-216 - Application and Finishing of Gypsum Panel Products 2021.
- T. GA-600 - Fire Resistance and Sound Control Design Manual 2021.
- U. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 REGULATORY REQUIREMENTS

- A. All products and materials must be approved for sale in and meet local, State, and Federal regulations.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Shop Drawings:
 - 1. Submit details associated with fire-rated partition head tracks coordinated with Section 07 84 00 - Firestopping, products submittal.
 - 2. Submit details associated with fireproofing and acoustic seals.
 - 3. Submit fully engineered shop drawings of all new partitions and soffits with special loading conditions including but not limited to: wall mounted cabinets, shelving, and counters specified herein. Submit design criteria, calculations, size and thickness designations, type, location, spacing, connection to building structure, supplemental bracing or accessories, fasteners and details required for proper installation. All shop drawings shall bear the seal of the licensed structural engineer employed by the gypsum board assemblies subcontractor, who is legally qualified to practice in the jurisdiction where the Project is located.
 - a. Provide calculations verifying that existing framing in walls to receive lead-lined gypsum board is capable of supporting loads.
 - b. Provide calculations for loadings and stresses of all framing that bear the seal of the licensed structural engineer.
 - 4. Submit color coded floor plans with partitions and soffits colors keyed to stud manufacturer's color coding system indicating extents of each stud / partition assembly type.
- C. Product Data:
 - 1. Submit manufacturer's metal stud load tables for typical stud partition loading and deflection criteria, where no special loads are present, identifying stud height, size and thickness selections.
 - 2. Provide data on metal framing runners, head tracks, metal framing, gypsum board, accessories, and joint finishing system.
 - a. Provide data on metal framing, shaftwall assemblies, gypsum board, accessories, and joint finishing system.

- b. Submit manufacturer's shaft wall tables for loading and deflection criteria, where no special loads are present, identifying stud height, size and thickness selections.
 - c. Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- 3. Steel Framing Industry Association (SFIA) Certification:
 - a. Submit documentation that metal studs and connectors used on project meet or exceed requirements of International Building Code.
- D. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- E. Test Reports: For stud framing products that do not comply with AISI S220 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.
- F. Evaluation Reports: Submit evaluation reports certified under an independent third-party inspection program administered by an agency accredited by IAS to ICC-ES AC98 accreditation criteria for inspection agencies, from ICC-ES, or other qualified testing agency acceptable to authorities having jurisdiction.
- G. Samples: Upon request, submit samples of all materials and accessories.

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- B. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified in accordance with the product-certification program of the Steel Framing Industry Association (SFIA) or similar organization providing a verifiable code-compliance program.
- C. Panel Products and Finishing Manufacturer: Unless otherwise indicated, gypsum board and other panel products, accessories and finishing materials shall be from a single manufacturer.
- D. Metal Framing Manufacturer: Unless otherwise indicated, steel framing for gypsum board assemblies shall be from a single manufacturer.
- E. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.
- F. Framing components and assemblies required to be engineered and detailed on shop drawings shall include proper accommodations for all live and dead loads, differential building movement, etc. Provide industry standard safety factors as suited to specific job conditions. To the extent that component types and sizes are indicated in the Contract Documents, they shall be considered minimum requirements to be verified and increased (but not decreased) as determined to be necessary by the metal stud contractor's engineer. Framing member depths indicated on the Drawings shall not be altered without the Architect's prior written authorization.
- G. All procedures and workmanship shall be in accordance with Gypsum Association GA-216 "Application and Finishing of Gypsum Board" and Gypsum Association Specifications for the Installation of Screw-Type Steel Framing Members to Receive Gypsum Board.

1.07 PRE-INSTALLATION MEETING

- A. At least 3 weeks prior to start of installation of metal framing systems, meet at the Project site with installers of other work including door and window frames, mechanical and electrical work. Review areas of potential interference and conflicts, coordinate layout, and support provisions for interfacing work.

1.08 DELIVERY, STORAGE AND HANDLING

- A. All materials shall be delivered to the job site in their original unopened containers or bundles, stored flat under conditions providing adequate protection from damage and exposure to elements and adequately protected from foul weather conditions.
- B. Steel framing and related accessories shall be stored and handled in accordance with AISI Code of Standard Practice.
- C. All fire-rated materials shall bear testing agency labels and required classification numbers.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
 - 1. See PART 3 for finishing requirements.
- B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
 - 1. Acoustic Attenuation: STC as indicated on the Drawings, calculated in accordance with ASTM E413 by a qualified independent testing agency, based on tests conducted in accordance with ASTM E90.
- C. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:
 - 1. Air Pressure Within Shaft: Sustained loads of 5 lbf/sq ft with maximum mid-span deflection of L/240.
 - 2. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- D. Fire Rated Assemblies: Provide complete assemblies as indicated on the Drawings. Materials and construction shall be identical to assemblies whose fire resistance rating has been determined per ASTM E119 by a testing and inspection service acceptable to the Authority Having Jurisdiction. Materials provided shall meet or exceed flame, fuel and smoke requirements of ASTM E84 surface burning characteristics for finish materials.
 - 1. Gypsum Association File Numbers: Comply with requirements of GA-600 for the particular assembly.
 - 2. UL Assembly Numbers: Comply with requirements listed for each particular assembly in the current UL Fire Resistance Directory.
- E. Seismic Design Requirements: Seismic Design Category C.
- F. Design Requirements:
 - 1. Steel partition stud maximum spacing: 16 inches on center.
 - 2. All partitions at a minimum, shall be capable of sustaining the uniform lateral load and the special loading imposed by wall cabinets as defined below.
 - a. Steel partition stud lateral deflections:
 - 1) Typical gypsum board faced partitions: L/240.
 - 2) Ceramic tile faced partitions: L/720.
 - b. Steel stud vertical deflection for soffits and ceilings:
 - 1) Typical gypsum board facing: L/240.
 - c. Steel partition stud uniform lateral loads:
 - 1) Typical gypsum board faced partitions: 5 PSF.
 - 2) Ceramic tile faced partitions: 8 PSF.
 - d. Steel partition stud special loads in addition to uniform lateral loads:
 - 1) At a minimum, all partitions with gypsum board finish:
 - 2) Wall mounted cabinets: Minimum 60 PLF applied vertically 6" from the face of the wall (for a 12" deep cabinet).

- 3) Wall mounted shelving: Minimum 20 PLF per shelf applied vertically 6" from the face of the wall for five shelves spaced 12" apart with top shelf at 6 feet AFF (for a 12" deep shelf).
- 4) Wall mounted counters: Minimum 100 PLF applied vertically 12" from the face of the wall (for a 24" deep counter) and applied vertically 15" from the face of the wall (for a 30" deep counter).
- 5) Fixed wall mounted computer supports: 45 pounds.
- 6) Adjustable wall mounted computer supports: 45 pounds applied at any point in any direction up to 45.5 inches from the wall surface.
- 7) Wall mounted video monitors: Minimum of 50 pounds, over area of wall indicated on the Drawings, applied vertically 4" from the face of the wall (for 8" deep monitor).
- 8) Wall mounted handrails: Minimum concentrated force of 200 pounds applied at any point in any direction and, but not simultaneously, a uniform load of 50 PLF applied in any direction 4" from the face of the wall.
- 9) Wall mounted stationary grab bars: Minimum concentrated force of 250 pounds applied at any point in any direction 4" from the face of the wall.
- 10) Wall mounted shower seats: Minimum concentrated force of 400 pounds applied at any point in any direction 12" from the face of the wall (for a 24" deep seat).
- 11) Wall mounted diaper changing stations: Minimum concentrated force of 200 pounds applied at any point in any direction 11" from the face of the wall (for a 22" deep changing station).
- 12) Wall supported gypsum board framed ceiling: Ceiling dead load of 7 PSF.
- 13) Wall mounted televisions: Minimum concentrated force of 60 pounds applied at any point in any direction 8" from the face of the wall.

2.02 METAL FRAMING MATERIALS

- A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.
- B. Manufacturers - Metal Framing, Connectors, and Accessories:
 1. ClarkDietrich Building Systems LLC.
 2. MarinoWARE.
 3. EB Metal U.S., Eastern Metal Framing LLC.
 4. Telling Industries.
 5. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Framing System Components: ASTM C645, roll-formed steel.
 1. Protective Coating: ASTM A653 minimum G60 (Z180) hot-dip galvanized corrosion resistant coating. Galvannealed products are unacceptable.
 2. Sizes: Sizes and properties necessary to comply with ASTM C754 and for the spacing, deflection and load conditions indicated, but in no case less than 27 mils (0.0269 inches) minimum thickness in spaces without a Patient Risk Level and with Patient Risk Level 1, 33 mils (0.0329 inches) in spaces with Patient Risk Levels 2 through 5. In all instances, framing shall be spaced a maximum of 16 inches center-to-center. At door openings to received lead-lined doors and frames and borrowed lights, provide a minimum 54 mil stud or two layers of wood blocking.
 3. Studs: C shaped with flat or formed webs, 1-1/4" legs (flanges) with embossed faces; web depths as indicated on the Drawings.
 4. Studs for heights exceeding C shaped formed web type stud capabilities: ASTM A1003 sheet steel, structural grade, Type H; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height. Thickness as required to meet specified performance levels, but in no case less than 43 mils thickness. Stud spacing shall not exceed 16 inches on center.
 5. Runners: U shaped, sized to match studs.

6. Flexible Track: Flexible framing consisting of adjustable leg straps and pivoting, hinged track brackets designed to provide curved framing assemblies of varying radii.
 7. Furring Channels: Hat-shaped sections, depth of 7/8 inch with 1/2 inch wide flanges; 20 ga (0.296 inch).
 8. Resilient Furring Channels: 1/2 inch depth, designed to reduce sound transmission, for attachment to substrate through one leg only; minimum 22 mils (0.022 inch)
 9. Channel Bridging and Bracing: U shaped; 54 mils thickness; minimum 0.5 inch wide flanges; depth as indicated or required.
 10. Flat Strap and Backing Plates: Continuous straps or plates of electro-galvanized sheet steel, widths as indicated, but not less than three (3) inches in wide. Actual size and thickness shall be as engineered by the stud manufacturer considering weight or loading resulting from items to be supported.
- D. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.
1. Shaft wall assemblies shall be engineered by the manufacturer/fabricator and shall be tested by an approved testing agency for fire-rating requirements as indicated on the Drawings. Deflection and load requirements as per paragraph 2.01 above.
 2. Shaft wall for multi-level 3 hour fire wall shall be 6 inch framing, minimum 18 gauge, unless calculations are provided that verify a smaller stud size or lighter gauge.
 3. All materials shall come from a single source.
 4. Products:
 - a. Same manufacturer as other framing materials.
- E. Ceiling and Soffit Suspension Systems: Comply with AISI S220 and ASTM C754.
1. Flat and Rod Steel Hangers: Zinc coated sheet steel; type and size as specified in ASTM C754 for spacing required; minimum flats size 1 inch x 3/16 inch by length required.
 2. Wire Hangers: ASTM A641, Class 1 zinc coating, soft temper, sized for the specific application, but in no case less than 0.162 inch diameter.
 3. Flat and Rod Steel Hangers: Zinc coated sheet steel; type and size as specified in ASTM C754 for spacing required; minimum flats size 1 inch x 3/16 inch by length required.
 4. Wire Hangers: ASTM A641, Class 1 zinc coating, soft temper, sized for the specific application, but in no case less than 0.162 inch diameter.
 5. Anchorage Devices: Corrosion resistant screws, clips, bolts, power-actuated fasteners compatible with support substrates, whose suitability has been proven through standard construction practices or by certified test data. Fasteners shall be capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E488.
 6. Framing System:
 - a. Main Runners: Cold-rolled, C shaped steel channels, 16 gauge min. Galvanized with G40 hot-dip coating per ASTM A653. Formed with radius as required for curved ceilings.
 - b. Cross Furring: Hat-shaped steel furring channels, AISI S220; 7/8 inch high, 25 gauge galvanized.
 - c. Furring Anchorages: ASTM C754; 16 gauge galvanized wire ties, manufacturer's standard wire-type clips, bolts, nails or screws as recommended by furring manufacturer.
 - d. Provide compression posts and other accessories as required to comply with seismic requirements.
 - e. Provide a fire-rated system, UL listed, where required.
 7. Alternate Proprietary Framing System:
 - a. Main and Cross Tees: Heavy duty classification 1-1/2" high integral reversible splice with knurled face. Cross tees 1-1/2" high with 1-1/2" wide face; quick release cross tees for positive locking and removability.
 - b. Provide all necessary accessories, splice clips, compression posts and moldings.

- c. Exposed framing members shall be finished with manufacturer's standard enamel paint finish.
 - d. System Deflection Criteria: L/360 maximum.
 - e. Provide a fire-rated system, UL listed, where required.
 - f. Products:
 - 1) USG Drywall Suspension System.
 - 2) Drywall Furring System by Armstrong World Industries, Inc.
 - 3) Substitutions: See Section 01 60 00 - Product Requirements.
- F. Clips (For securing metal framing to structural steel components intended to receive sprayed-on fireproofing): Galvanized steel, depth as required for thicknesses of fireproofing, size and thickness as determined by system engineering.
- G. Partition Head To Differential Structure Connections (Deflection Head Tracks) Non-fire Rated:
 - 1. Primary and secondary steel deflection dimensions are indicated on the drawings. Movement joints with sealant shall accommodate the 50% movement ability of sealant.
 - 2. Provide track fastened to structure with legs of sufficient length to accommodate movement required, for friction fit of studs cut short and fastened as determined by the fabricator/installer's engineering. In no case shall tracks be less than 33 mils; ASTM C653 sheet steel, SS Grade 50/340, with G60/Z180 hot dipped galvanized coating. Options include:
 - a. Single Long-Leg Runner System: 2 inch minimum deep flanges, gauge as required by engineering but not less than stud gauge, installed with studs friction fit into top runner, with continuous bridging located within 12 inches of the top of studs or other mechanical anchorage to allow vertical movement but prevent rotation of studs while maintaining structural performance of the partition.
 - b. Double-Runner System: 2 inch minimum deep flanges in gauge as required by engineering and fastened to studs, with an outer runner sized to friction fit inside runner and in gauge as required by engineering but not less than stud gauge.
- H. Partition Head to Differential Structure Connections (Deflection Head Tracks) Fire Rated:
 - 1. Primary and secondary steel deflection dimensions are indicated on the drawings. Movement joints with sealant shall accommodate the 50% movement ability of sealant.
 - 2. For fire rated assemblies with greater than ½ inch differential vertical movement requirements:
 - a. Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and/or anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
 - b. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
 - c. Material: ASTM A653 steel sheet, SS Grade 50/340, with G60/Z180 hot dipped galvanized coating.
 - d. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.
 - e. Deflection and Firestop Track:
 - 1) Products:
 - (a) Posi Clip with Fire Trak by Fire Trak Corp. (for movement > 2")
 - (b) Fire Trak by Fire Trak Corp (for movement < 2")
 - (c) Blaze Frame DSL Series by Clark Dietrich (for movement 1/2" to 1-1/2")
- I. Non-structural Framing Accessories:
 - 1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
- J. Framing supporting floor/seating areas:
 - 1. Applications: Learning Commons tiered seating.

2. Framing components and assemblies to be engineered and detailed on shop drawings shall include proper accommodations for all live and dead loads, differential building movement, etc. Provide industry standard safety factors as suited to specific job conditions. To the extent that component types and sizes are indicated in the Contract Documents, they shall be considered minimum requirements to be verified and increased (but not decreased) as determined to be necessary by the contractor's engineer.
3. Accommodate 400lb point load, 8psf dead load, 100psf live load. Deflection shall not exceed L/480.

2.03 BOARD MATERIALS

- A. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 2. Moisture/Mold-Resistant (MR) Gypsum Wallboard, ASTM D3273: Score of 10.
 - a. Applications: At wet areas, wall within 4 feet of sinks or drinking fountains, restrooms, shower rooms, kitchens and other locations indicated on the Drawings.
 3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type-X board, UL or WH listed.
 4. Thickness: 5/8 inch.
 5. Paper-Faced Products:
 - a. CertainTeed Corp; ProRoc Type X Gypsum Board.
 - b. Georgia-Pacific Gypsum; ToughRock Fireguard X, and ToughRock FireGuard C.
 - c. National Gypsum Co; Gold Bond Brand Gypsum Wallboard.
 - d. USG Corp; Sheetrock Brand Gypsum Panels.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
 6. Moisture/Mold-Resistant, Paper-Faced Products:
 - a. CertainTeed Corporation; M2Tech 5/8" Type X Moisture & Mold Resistant Drywall.
 - b. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard.
 - c. National Gypsum Co; Gold Bond Brand XP FireShield Gypsum Board with Sporgard.
 - d. USG Corp; Sheetrock Brand Mold Tough Firecode X Gypsum Panels.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Shaftwall Board: Type X; 1 inch thick by 24 inches wide, beveled long edges, ends square cut.
 1. Glass Mat Faced Type: ASTM C1658, glass mat shaftliner gypsum panel or glass mat coreboard gypsum panel.
 2. Mold Resistance, ASTM D3273: Score of 10.
 3. Glass Mat Faced Products:
 - a. CertainTeed Corporation; GlasRoc Shaftliner Type X.
 - b. Georgia-Pacific Gypsum; DensGlass Shaftliner.
 - c. National Gypsum Co; Gold Bond Brand e2XP Extended Exposure Shaftliner.
 - d. USG Corporation; Sheetrock Brand Glass-Mat Liner Panels Mold Tough.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 GYPSUM BOARD ACCESSORIES

- A. Acoustic Insulation: See Section 07 21 00.
- B. Acoustic and Smoke Sealant: As specified in Section 07 90 05.
- C. Firestopping: As specified in Section 07 84 00.
- D. Finishing Accessories for Wallboard: ASTM C1047, galvanized steel or rolled zinc, not less than 30 gauge, unless otherwise indicated.
 1. General Types: As detailed or required for finished appearance.
 2. "J" Beads: Channel shaped with a concealed wing not less than 1-1/8" wide and an exposed wing, equal to Type 400. "J" beads may be used only where specifically identified

- on the Drawings or otherwise approved by the Architect. All other edge trim shall be Casing Beads.
3. Casing and Trim Beads: Channel and angle types as required, screwed into place and suitable for finishing with joint compound, equal to Type 200 by Phillips.
 4. Edge Beads: (For use at perimeter of ceilings) Channel or angle-shaped with wings not less than 3/4" wide. Exposed wing edge shall be folded flat, with bead for taping and floating, equal to Type 200 by Phillips.
 5. Reveal Trim: Channel shaped with wings for screwing and joint treatment. Finished reveal shall be depth of wallboard by 3/8" wide.
 - a. Product: Fry Reglet; Reveal DRM Series or equal.
 6. "L" Trim: L Shaped extruded aluminum edge trim with wings for screwing and joint treatment. Depths as indicated per the Drawings. Finish: Clear anodized.
 - a. Product: "L" Trim Molding DRML Series by Fry Reglet or equal.
 7. Control Joints: Zinc extrusions equal to Type 093 by Trimtex, or deep rigid PVC extrusions equal to Type 093V by Trimtex for larger joints.
 8. Manufacturers:
 - a. Fry Reglet.
 - b. Phillips Manufacturing Co.
 - c. Trim-tex, Inc.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Joint Materials: ASTM C475 and as recommended by gypsum board manufacturer for project conditions.
1. Tape: 2 inch wide, creased paper tape for joints and corners for all interior locations.
 2. Joint Compound: Drying type, vinyl-based, ready-mixed.
 3. Joint Compound: Setting type, field-mixed.
- F. High Build Drywall Surfer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
1. Applications:
 - a. For semi-gloss painted surfaces and walls scheduled to receive wall coverings per Section 09 72 60.
 - b. Other locations where indicated in the Drawings.
 2. Products: Tuff-Hide manufactured by USG, or equal.
- G. Screws for gypsum board attachment to Steel Members Less Than 0.03 inch In thickness; to Wood Members; ASTM C1002; self-piercing tapping type, Type W for wood studs and Type S for steel studs, 1-1/4" length.
1. Coatings: Black oxide coated for general use; Zinc plated chromate for areas where mold-resistant gypsum board is specified.
- H. Screws for gypsum board attachment to Steel Members From 0.033 to 0.112 Inch in thickness: ASTM C 954; steel drill screws for application of gypsum board to loadbearing steel studs.
1. Size, penetration and spacing shall be in strict accordance with the stud manufacturer's recommendations and the stud fabricator's engineering requirements. Penetration through joined steel materials shall not be less than 3 exposed threads or 3/8".
 2. Coatings:
 - a. General interior areas: Corrosion resistant, zinc plated with chromate complying with ASTM B633 and B117.
 - b. Potentially damp interior areas, and where mold-resistant gypsum board is specified: High performance polymer coating, complying with ASTM B117; salt spray test result of no rust or other base metal corrosion after a minimum of 800 hours.
 - 1) Products: Stahlgard by ELCO, Kwik-Cote by Hilti, or approved equal.

- I. Anchorage to Substrate: Anchorage of tracks to the structure (size, penetration, type and spacing) shall be in strict accordance with the stud fabricator/installer's engineering requirements for the specific application and shall rigidly secure materials in place.
- J. Accessories for Lead-Lined Gypsum Board: Comply with ASTM B749, Type L51121.
 - 1. Joint Materials: Lead batten strips, corners, and shims of same thickness as laminated lead sheets.
 - 2. Backing for Penetrations: Lead backing of same thickness as laminated lead sheets.
 - 3. Screw Covers: Lead discs for covering screw heads, of same thickness as laminated lead sheets.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this Section to commence.

3.02 SHAFT WALL INSTALLATION

- A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.
 - 1. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 24 inches on center.
 - 2. Install firestopping sealant in a continuous application at the perimeter of the shaftwall in coordination with framing installation and Section 07 84 00.
 - 3. Install J-runners or E-studs on columns and beams before fireproofing installation. Remove all fireproofing over-spray from shaft wall framing before installing gypsum liner panels.
 - 4. Install studs at spacing required to meet performance requirements. C-H studs shall be sized 3/8 inch to 1/2 inch less than the floor-to-ceiling height, and installed between liner panels. Install full length E-studs or J-runners vertically at T intersections, corners, door jambs, and columns. Install full length E-studs over gypsum liner panels both sides of closure panels. For openings, frame with vertical E-stud or J-runner at edges and horizontal J-runner at head and sill. Frame all openings as required to maintain structural support of wall. Isolate framing from transfer of lateral and vertical structural loading to the system. Provide movement relief type joints per manufacturer's instructions to attain proper lateral support.
 - 5. For openings, frame with vertical E-stud or J-runner at edges and horizontal J-runner at head and sill. Frame all openings as required to maintain structural support of wall.
 - 6. Support elevator hoistway door opening equipment independently of shaftwall framing system. Frame opening for elevator hoistway door frame in accordance with requirements of elevator and shaftwall manufacturer.
 - 7. Install supplemental framing and bracing to support fixtures, equipment, services, heavy trim, etc which cannot be adequately supported directly on shaftwall framing.
- B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.
- C. Horizontal Shaftwall Systems: Studs for horizontal systems shall be sized to accommodate partition dead loads as well as other applicable loads.
- D. Seal perimeter of shaft wall and penetrations with firestop sealant.
- E. Shaft Wall with Finish on One Side:
 - 1. Install gypsum board in a double layer on one side, either horizontally or vertically.
 - 2. Install the first layer of gypsum board horizontally with approved fasteners spaced 24 inches o.c. and 3 inches from all edges.
 - 3. Offset the horizontal joints minimum 12 inches from any splice joints in the liner board panels.
 - 4. Install the face layer of gypsum board parallel to the framing with approved fasteners spaced minimum 12 inches o.c. and 6 inches from all edges.

5. Finish joints with tape and compound.

3.03 FRAMING INSTALLATION

- A. Metal Framing: Comply with ASTM C 754, fabricator's engineering drawings and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated and in accordance with fabricator's engineering drawings. Suspend carrying channels from structure above at not more than 4 feet on center and within 6 inches of walls. Attach furring channels to the carrying channels at no more than 16 inches on center and within 2 inches of walls.
 1. Level ceiling system to a tolerance of 1/8" in 12'.
 2. Install hangers plumb and free of contact with other objects that are not part of the supporting system for the ceiling. Install supplemental suspension members where width of ducts or other construction interferes with hanger locations.
 3. Provide control and expansion joints as indicated on the Drawings, or otherwise required.
 4. Laterally brace entire suspension system. Reinforce openings in suspension system which interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing a minimum of 24 inches past each opening.
 5. NOTE: At the Contractor's option, drywall direct suspension systems may be used, in lieu of the carrying/furring channel system, subject to review and acceptance by the Architect. Direct (proprietary) suspension systems shall be complete with main beams, cross channels, wall angles, clips, and hangers, and shall be as recommended by the gypsum board manufacturer for the proposed installations. Systems shall be suitable for fire-rated installations as required.
 6. Fasteners for hanger wires shall be of types and sizes that will resist corrosion, and provide lasting anchorage without pullout or failure. Verify compatibility with structure to receive fasteners prior to proceeding. Do not attach hangers to steel roof deck or steel deck tabs.
- C. Runner Tracks: Install continuous tracks sized to match stud, aligned accurately to layout at base and tops of studs. Secure tracks as recommended by stud manufacturer and engineered design for type of construction involved.
- D. Coordination with sprayed on fireproofing: Install offset clips to structural steel surfaces according to engineered shop drawings prior to installation of light gauge steel framing members. Do not conceal sprayed-on fireproofing by other construction until required fireproofing inspection is completed and required repairs have been accepted.
 1. At existing fireproofing, remove only as much fireproofing as needed to complete installation of offset clips for support of new light gauge framing. Spray fireproofing shall be touched up to maintain required coverage and thickness for fire resistive rating as part of the scope of Section 07 81 00.
- E. Studs: Space studs at 16 inches on center unless closer spacing is required by the fabricator's engineering. Spacing shall not exceed 16 inches without the Architect's prior written authorization.
 1. Extend partition framing to structure in all locations.
 2. Partitions Terminating at Structure: Provide deflection head track at all locations where metal framing is attached to or otherwise affected by the deflection of other structural building components. Secure the top of studs in such a way as to allow movement of the deflection head track with respect to the studs. Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging, or as otherwise required by the fabricator's engineering drawings.
 3. Provide minimum clear space as indicated on the partition types on the Drawings for deflection.

- F. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs of all window and door openings and shall be located not more than 2 inches from frames jambs. Two jamb studs shall be used for any opening larger than 2 feet square. Over door frames install a cut-to-length section of runner with flanges slit and web bent to allow flanges to overlap adjacent vertical studs and securely screw-attached to adjacent studs. A cut-to-length stud extending from door frame header to ceiling runner shall be positioned over the door frame.
 - 1. Provide additional framing as required by engineered design to reinforce headers for adequate stability.
 - 2. Unless otherwise indicated on the Drawings, partitions above and below door and window openings shall be the same construction as adjacent partitions.
- G. Blocking: As part of the scope of Section 06 10 54 - Wood Blocking and Curbing, install wood blocking for support of:
 - 1. Framed openings.
 - 2. Wall-mounted cabinets.
 - 3. Plumbing fixtures.
 - 4. Toilet partitions.
 - 5. Toilet accessories.
 - 6. Wall-mounted door hardware.
 - 7. Grab bars and hand rails
 - 8. Wall mounted countertops
- H. Supplemental Framing: Install supplementary framing, blocking and bracing in metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the walls or partitions. Where type of supplementary support is not otherwise indicated by the engineered design, comply with stud manufacturer's recommendations and industry standards in each case, considering weight or loading resulting from item supported, for firm and rigid construction.
- I. Lead-Lined Door and Borrowed Light Openings: Provide minimum 54 mil studs or two layers of wood blocking per Section 06 10 54 - Wood Blocking and Curbing for all lead-lined door and borrowed light openings.
- J. Penetration and Opening Insulation: Install firesafing insulation as required to meet firestop product manufacturer's tested assemblies for all openings and penetrations in fire-rated construction, smoke partitions and at acoustic sealing. Openings shall include steel deck flutes, structural penetrations, mechanical, electrical, piping, etc. Provide any necessary extra studs, furring channels or stick-clips to ensure that insulation will remain in proper alignment and fit around items penetrating partitions.
- K. Expansion and Control Joints: Provide studs at each side of all horizontal and vertical joints. Space studs to align with width of joints. Stuff voids between studs full with firesafing insulation at all locations.
- L. Fire-resistive Wall and Ceiling Assemblies: Where fire-rated assemblies are required, provide materials and construction identical to the Underwriters Laboratories (U.L.) tested assemblies as referenced on the Drawings.

3.04 ACOUSTICAL CONSTRUCTION

- A. The following requirements shall apply to all non-fire rated ceilings and partitions indicated on the Drawings to be "Acoustical Construction". Special attention shall be paid to the proper installation of acoustical construction components.
- B. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions. Prior to installation of gypsum board, verify that acoustical insulation is in place and secure, completely filling all voids.

- C. Acoustic Sealant (at non-fire-rated construction): Install in accordance with manufacturer's instructions. Seal all cracks, joints, deck flutes, piping, conduit, duct penetrations and voids in "Acoustical Construction" air tight with sound sealing products, as specified in Section 07 90 05 – Joint Sealers.
 - 1. Place continuous bead at perimeter of each layer of gypsum board.
 - 2. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.
- D. At partition heads, install mineral fiber insulation in all voids at deck flutes and deflection head tracks which will act as backer for acoustic sealant. Top of partition joints to building structure are high movement joints and shall be sealed in accordance with Section 07 90 05 – Joint Sealers.

3.05 BOARD INSTALLATION

- A. General: Inspect materials to which gypsum board is to be applied. Remedy all defects prior to installation of gypsum materials. Maintain a uniform room temperature between 55 and 65 degrees F during application and until completely dry or occupied. Provide adequate ventilation to carry off excess moisture.
- B. Field verify the layout of all walls and partitions prior to proceeding with the Work, in order to avoid dimensional errors and confirm proper placement. Verify that all required insulations are properly in place prior to covering up.
- C. Where the Drawings indicate multiple partition or wall types back-to-back, each scheduled type shall be complete. Inner layers of insulation or gypsum board shall not be omitted.
- D. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
 - 1. Gypsum wallboard shall be cut by scoring and breaking, or by sawing, working from the face side. Scribe neatly to projecting surfaces and fit wallboard neatly around pipes, ducts and other penetrations.
 - 2. Apply wallboard first to soffits (ceilings) then to walls. Allow 1/4" maximum space between bottom of wall sheets and floor, unless otherwise noted. Apply wallboard at interior soffits with long dimensions of board perpendicular to axis of supports.
 - 3. At ductwork and piping provide a 1/2 inch gap between the drywall and the penetrating element to minimize any vibrational noise transmission to the partition. Void shall be acoustically sealed.
- E. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
- F. Double-Layer, Nonrated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
- G. Fastening Gypsum Wall and Soffit Board: Wallboard shall be held in firm contact with the supports while the fasteners are being driven. Fasteners shall proceed from central portion of board towards ends and edges. Fasteners shall be driven home with the heads slightly below the surface of the board in a dimple formed by the driving tool. Care shall be taken to avoid breaking the paper face. Improperly driven fasteners shall be removed.
 - 1. In general, drywall screws shall be spaced not to exceed 16 inches o.c. At fire-resistive construction, space screws 12 inches o.c. in field and 8 inches o.c. at board perimeters, unless otherwise required by the applicable U. L. fire-rated assembly.
- H. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- I. Installation on Metal Framing: Use screws for attachment of all gypsum board.
- J. Curved Surfaces:

1. Comply with manufacturer's requirements relative to curve radiuses, wetting methods, stacking of panels after wetting and other preparations that precede installation of gypsum panels.
2. Comply with manufacturer's requirements for fastener type and spacing.
3. For curves less than 10' of arc, select gypsum panel lengths and cut them as required to produce an unbroken panel covering for each curved surface plus 12" long for straight sections at ends of curves and tangent to them.
4. Wet gypsum panels on surfaces that will become compressed when panels are installed on curve and where curve radius prevents using dry panels.
5. Apply gypsum panels with wrapped edges perpendicular to framing.
6. On convex sides of walls, install from one end of curved surface and fasten gypsum panels to framing as they are wrapped around the curve.
7. On concave sides of walls, start fastening panels to framing at center of curve and work outward to panel ends.
8. Fasten panels to framing with screws spaced no greater than 12 inches apart.
9. Double Layer Construction: Apply base layer perpendicular to framing, off setting base layer from face layer joints one framing member apart. Fasten to framing with screws spaced no greater than 12" apart.
10. Allow wetted gypsum panels to dry before applying joint treatment.
11. Instead of using wetted panels, application of multiple layers of 1/4" or 3/8" thickness gypsum panels to form greater thicknesses is acceptable for non-fire rated assemblies.

3.06 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces, as recommended by the gypsum board manufacturer, ASTM C840 and as indicated. Locations not indicated on the Drawings shall be located by the Contractor subject to the Architect's prior approval. Provide control joints or expansion joints where partitions, walls, ceilings, or soffits cross construction or building joints in stud framing or other supporting materials.
 1. At building expansion joints.
 2. At intersections of dissimilar substrates or finish materials.
 3. At floor lines.
 4. At ceiling and soffit intersections with a structural element or the vertical penetration.
 5. At ceiling wings of "L", "U" and "T" shaped ceiling areas.
 6. At openings more than 6 feet long.
 7. Adjacent to corners and intersections of walls within a distance equal to half the general control joint spacing noted above.
 8. At walls not more than 30 feet apart and ceilings over 30 feet long with out relief.
 9. At walls with tile finish, no more than 16 feet apart in either direction.
 10. At exterior soffits, not more than 20 feet apart in both directions.
 11. At locations where concentrated stress or movement is anticipated.
 12. At all locations identified on the Drawings.
 13. At locations as recommended by the board manufacturer.
- B. Control joint width shall be as required to accommodate anticipated movement.
- C. Control joint in fire-rated construction shall meet requirements of the fire-resistive tested assemblies.
- D. Wall boards shall be discontinuous at the joint, sealant shall fill the gap and control joint trim shall be fastened at both flanges along the entire length of the joint.
- E. Corner Beads: Install with screws at external corners, using longest practical lengths.
- F. Casing Beads: Install at locations where gypsum board abuts dissimilar materials and as indicated.

3.07 JOINT TREATMENT

- A. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.
- B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 5: Areas to receive semi-gloss paint finishes, areas scheduled to receive wall coverings and other areas indicated per the Drawings.
 - 2. Level 4: Walls and ceilings to receive paint finish, unless otherwise indicated.
 - 3. Level 3: On walls to receive wall protection.
 - 4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 - 5. Level 1: Wall areas above finished ceilings and in attics, whether or not accessible in the completed construction.
- C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
 - 2. Taping, filling and sanding is not required at base layer of double layer applications, except as required in fire-rated applications.
- D. All wallboard in fire-rated and smoke sealed construction shall be sealed when penetrated by pipes, conduits, wire, structure, etc.
 - 1. Smoke sealed assemblies shall be sealed tight to abutting construction with sealant products.
 - 2. Fire-rated assemblies shall be sealed tight to abutting construction with firestopping products in order to provide continuous, uninterrupted fire protection.
- E. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.08 MARKING OF FIRE AND SMOKE RESISTIVE CONSTRUCTION

- A. Prepare stenciled signs for painted marking of all fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions as identified on the Code Analysis Drawings, above accessible ceilings, in attics and in accessible concealed floor spaces, at intervals not exceeding ten (10) feet measured horizontally.
 - 1. Lettering shall be 3 inches high, 3/8 inch min. stroke, of contrasting color to the application surface.
 - 2. Sign text shall be as follows, as applicable:
 - a. FIRE BARRIER - PROTECT ALL OPENINGS
 - b. SMOKE PARTITION - PROTECT ALL OPENINGS

3.09 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.10 PROTECTION

- A. Protect installed gypsum board assemblies from subsequent construction operations.

END OF SECTION

**SECTION 09 30 00
TILING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Floor tile and base.
- B. Wall tile.
- C. Accessories and trim.
- D. Sealants at tile joints.
- E. Note: See the Drawings for special conditions, details, patterns, alternate colors, inserts, etc.

1.02 RELATED REQUIREMENTS

- A. Section 07 90 05 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- B. Section 09 05 61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.
- C. Division 22 - Plumbing: Floor drains.
- D. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.03 REFERENCE STANDARDS

- A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium) 2019.
- B. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive 2019.
- C. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy 1999 (Reaffirmed 2019).
- D. Tile with Modified Epoxy Emulsion Mortar/Grout 1999 (Reaffirmed 2019).
- E. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework 2017 (Reaffirmed 2022).
- F. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive 2021.
- G. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation 2014 (Reaffirmed 2019).
- H. ANSI A137.1 - American National Standard Specifications for Ceramic Tile 2022.
- I. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products 2018 (Reapproved 2023).
- J. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation 2023.

1.04 REGULATORY REQUIREMENTS

- A. All products and materials must be approved for sale in and meet local, State, and Federal regulations.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meeting: Convene a pre-installation meeting at least two weeks before starting work of this Section; require attendance by all affected installers.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, backer board, sealant and accessories. Include instructions for using grouts and adhesives.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- D. Shop Drawings:
 - 1. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
- E. Samples: Submit confirmation samples of each tile and color selected.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Tile: 5 percent of each size, color, and surface finish combination, but not less than 5 square feet of each type.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this Section, with minimum ten years of documented experience.
- B. Installer Qualifications:
 - 1. Company specializing in performing tile installation, with minimum of five years of documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.
- B. Deliver all products to job site in manufacturer's unopened, original containers with grade seals and marking intact. Keep tile cartons dry.

1.09 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature of 50 degrees F during installation of tilework and for 7 days after completion.
- C. Provide adequate lighting for good grouting and cleanup.
- D. Place in clean marked cartons exclusively for the Owner's use. Send written notice to the Architect identifying the quantity and location of extra tile furnished.

1.10 OWNER TRAINING

- A. A tile cleaning and maintenance training session for the Owner shall be held at the completed facility conducted by a qualified representative of the tile manufacturer. Printed tile maintenance instructions shall be provided to the Owner in advance of the training session.

PART 2 PRODUCTS

2.01 TILE

- A. Basis of Design Product:
 - 1. As indicated below.
 - 2. All substitutions must be submitted to Architect during bidding for Architect and Owner approval.
 - a. Substitutions: See Section 01 60 00-Product Requirements.
- B. Floor Tile, Type TC-1: ANSI A137.3 Porcelain.
 - 1. Sizes, Shapes and Colors: See Finish Legend.
 - 2. Thickness: 3/8 inch

3. Grout Joint: 3/16 inch.
 4. Moisture Absorption, ASTM C373: < 0.5 percent.
 5. D.C.O.F Coefficient of Friction, A137.1: > 0.42-0.52.
 6. Breaking Strength, ASTM C648: > 450 lbs
 7. Scratch Hardness, MOHS 7.0.
 8. Basis of Design:
 - a. Crossville; Portland Cliff.
 - b. Substitutions: See Section 01 60 00-Product Requirements.
- C. Wall Tile, Type TC-2: ANSI A137.1 Glazed Ceramic.
1. Sizes, Shapes and Colors: See Finish Legend.
 2. Thickness: 5/16 inch
 3. Grout Joint: 1/16 inch.
 4. Moisture Absorption, ASTM C373: ≤ 20 percent.
 5. Breaking Strength, ASTM C648: > 125 lbs
 6. Scratch Hardness, MOHS > 4.0.
 7. Basis of Design:
 - a. Daltile; Color Wheel Classic.
 - b. Substitutions: See Section 01 60 00-Product Requirements.

2.02 TRIM AND ACCESSORIES

- A. Tile Edge and Floor Transition Trim: Anodized aluminum or stainless steel as indicated, style and dimensions to suit application, for setting using tile mortar or adhesive.
1. NOTE: All flooring transitions shall be executed to provide a smooth and level floor surface, compliant with ADA.
 2. Finish: As indicated on Finish Legend.
 3. Applications:
 - a. Where indicated on Finish Legend.
 - b. Profiles as indicated on Finish Legend.
 4. Basis of Design Manufacturer:
 - a. Schluter Systems.
 - b. Acceptable Substitute Manufacturers:
 - 1) Custom Building Products.
 - 2) Substitutions: See Section 01 60 00 - Product Requirements.

2.03 SETTING MATERIALS

- A. Epoxy Adhesive and Mortar Bond Coat: ANSI A118.3.
1. Applications: Typical setting material for walls and floors.
 2. Products:
 - a. LATICRETE International, Inc; Latapoxy 300 Adhesive.
 - b. Mapei Corporation; Kerapoxy 410.
 - c. Custom Building Products; EBM-Lite Epoxy Bonding Mortar.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 GROUTS

- A. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
1. Applications: Typical grout unless otherwise noted.
 2. Color(s): As indicated on drawings.
 3. Products:
 - a. LATICRETE International, Inc; LATICRETE SPECTRALOCK PRO Premium Grout.
 - b. Mapei Corporation; Kerapoxy CQ.
 - c. Custom Building Products; CEG-Lite 100% Solids Commercial Epoxy Grout.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 ACCESSORY MATERIALS

- A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
 - 1. Crack Resistance: No failure at 1/8 inch gap, minimum.
 - 2. Fluid or Trowel Applied Type with reinforcing fabric:
 - a. Material: Synthetic rubber or Acrylic.
 - b. Thickness: 20 mils, maximum.
 - 3. Products:
 - a. LATICRETE International, Inc; LATICRETE FRACTURE BAN SC.
 - b. Mapei Corporation; Mapelastic CI.
 - c. Custom Building Products; FractureFree Crack Prevention Membrane.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Self-Leveling Underlayment: Cement-based; minimum thickness 1/8".
 - 1. Applications: For all large-format ceramic tile floor areas except toilet rooms.
 - 2. Tensile Strength, ASTM C1583: 270-340 PSI.
 - 3. Flexural Strength, ASTM C1708: 840-1100 PSI at 28 days.
 - 4. Compressive Strength, ASTM C1708: 4,400 PSI at 28 days.
 - 5. Product:
 - a. LATICRETE International, Inc; Drytek Levellex Plus.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Tile Backer Board:
 - 1. Cementitious Backer Board: ANSI A118.9; High density, cementitious, glass fiber reinforced, 5/8 inch thick; 2 inch wide coated glass fiber tape for joints and corners.
 - 2. Products:
 - a. USG Corporation; Durock Brand Cement Board with Edgeguard.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Mesh Tape: 2 inch wide self-adhesive fiberglass mesh tape.
- E. Tile and Grout Cleaners / Sealers: As recommended by the tile and grout manufacturers.
- F. Sealant:
 - 1. Silicone Sealant: ASTM C920, Type S ,Grade NS, Uses T1, T2, NT, I,M, G, A and O, and conforms to ASTM C794 adhesion properties.
 - a. Color: As selected by the Architect from the manufacturer's full color range.
 - b. Applications:
 - 1) Control, expansion, and corner joints within ceramic tile at floor and walls and joint between floor and walls.
 - c. Products:
 - 1) Mapei; Mapesil T Plus.
 - 2) Custom Building Products; Commercial 100% Silicone Sealant.
 - 3) Substitutions: See Section 01 60 00 - Product Requirements.
- G. Backup Filler: Flexible and compressible type as recommended by sealant manufacturer for its intended use. Provide materials in sizes and shapes required. Materials shall be non-staining and compatible with the sealant used.

PART 3 EXECUTION

3.01 FLOOR TILE - EXAMINATION AND PREPARATION

- A. Before installing any ceramic tile inspect surfaces to receive tile and accessories. Notify the Architect and Contractor in writing of any defects or conditions that will prevent a satisfactory tile installation. Do not proceed with installation until satisfactory corrections have been made. Start of work implies acceptance of surfaces to receive tile.

- B. See Section 09 05 61 - Common Work Results for Flooring Preparation, for concrete slab preparation and testing prior to flooring installation..
- C. Where floor drains are provided, tile floors shall slope to drains. Verify proper floor pitches prior to start of the Work. Elevation adjustment coat shall be provided as required. All conditions requiring adjustments shall be reviewed with the Architect prior to start of Work. Any room with a floor drain shall slope to the drain at between 1% and 2% slope.
 - 1. All areas within 8' of the floor drain shall slope to drain (or entire room if room is smaller than the 8' radius allows), or as drawings otherwise indicate.
 - 2. At door and partition locations – the floor shall be set to the floor level (with the drain being lower than the floor level).
 - 3. Floor pitch shall be laser verified with results submitted to the Architect and Owner.
- D. Large Format Tile: Verify that sub-floor surfaces are smooth and flat, within tolerances of not more than 1/16" in 3 feet and are ready to receive tile. Leveling coat shall be provided as required.
 - 1. Applications: Floor tile with any dimension greater than 15 inches.
 - 2. Concrete slab surface shall be roughened prior to installation and meet an ICRI CSP Profile 3 – 5.
 - 3. Surface shall be clean and free from dirt, dust, sealer or other surface contaminants. Prime all areas and allow to dry prior to installation of self-leveling underlayment.
 - 4. Install self-leveling underlayment. Materials may be installed from 1/8 to 1-1/4 inch thickness. Allow to properly cure prior to proceeding with installation.
- E. Adjust sub-floor surfaces at transitions to other flooring materials to provide a smooth transition of floor surfaces to facilitate movement of wheeled equipment, wheelchairs and minimizes tripping hazards.
 - 1. Mock-ups of each type of flooring transition shall be tested by the Owner and approved by the Architect prior to project-wide implementation.
- F. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

3.02 WALL TILE - EXAMINATION AND PREPARATION

- A. Do not start work until blocking, electrical, and mechanical work in or behind tile have been installed. Protect surrounding work from damage.
- B. Install tile backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.
 - 1. Use galvanized or corrosion resistant coated fasteners.
 - 2. Installation of tile backing board for tile-faced design walls shall provide a flat and even surface to help ensure a proper installation of this appearance critical wall surfacing.
- C. Before installing any ceramic tile inspect surfaces to receive tile and accessories. Notify the Contractor and Architect in writing of any defects or conditions that will prevent a satisfactory tile installation. Do not proceed with installation until satisfactory corrections have been made. Start of work implies acceptance of surfaces to receive tile.
- D. Verify that wall surfaces are smooth and flat, with square corners, within the tolerances specified for that type of work, are dust-free, and are ready to receive tile. Leveling coat shall be provided as required. Vacuum clean surfaces and damp clean.
- E. Small Format Wall Tile: Wall surface tolerance shall be not more than 1/8" in 8 feet out of flat.
- F. Large Format Wall Tile: Wall substrate shall meet tile manufacturer's requirements for wall substrate flatness and shall be verified by laser prior to tile installation. Confirm results with Owner and Architect.
- G. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

- A. Install tile and grout in accordance with best current practice of the industry and applicable requirements of ANSI A108.1 through A108.13, manufacturer's instructions, and TCNA Handbook recommendations.
- B. Field verify all layouts and patterns with the Architect prior to proceeding. Lay tile to pattern indicated. Do not interrupt tile pattern through openings. Align joints when adjoining tiles on floor, base, walls and trim are the same size.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Make all cuts on the outer edges of the field. Smooth all cut edges with a carborundum stone, and install no tile with jagged or flaked edges. Form corners and bases neatly. Align floor joints.
- D. Extend tile into recesses and under equipment and fixtures to form a complete covering without interruption.
- E. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- F. All ceramic tile finish for stair treads shall be configured to create a contrasting strip at the tread nosing. Installation of tread tiles shall not proceed without confirmation by the Architect of proper contrast.
- G. Install non-ceramic trim in accordance with manufacturer's instructions.
- H. Install thresholds where indicated.
- I. Sound tile after setting. Replace hollow sounding units.
- J. Keep control and expansion joints free of mortar, grout, and adhesive.
- K. Expansion Joints: Provide expansion joints directly over all building movement joints, whenever tile abuts restraining surfaces and not more than 20' on center each way in the tile field. Proposed joint details and locations shall be submitted for review to the Architect. Keep expansion joints free of adhesive or grout. Apply sealant to joints.
 - 1. Expansion joints over movement joints shall be equal in width to the joints below. Other expansion joints shall be width of grout joint or 1/8", whichever is greater.
 - 2. Install in accordance with TCA Handbook Method EJ171.
- L. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- M. Grout tile joints. Epoxy grout shall be removed from tile surfaces immediately during grouting operations.
- N. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.
- O. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes. All inside corner of ceramic wall tile in wet areas shall be kept free of grout and shall be sealed with a continuous bead of silicone, color to match grout.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

- A. Over interior concrete slab-on-grade substrates, install in accordance with TCNA (HB) Method F116E, with crack isolation membrane, epoxy bond coat and epoxy grout, unless otherwise indicated.
- B. Over interior above ground concrete suspended slab substrates, install in accordance with TCNA (HB) Method F115A, with waterproofing membrane, epoxy bond coat and epoxy grout, unless otherwise indicated.

3.05 INSTALLATION - WALL TILE

- A. Over cementitious backer units install in accordance with TCNA (HB) Method W244C, with epoxy bond coat epoxy grout, unless otherwise indicated.

3.06 CLEANING

- A. Upon completion of setting and grouting, sponge and wash tile thoroughly, diagonally across joints. Use tile and grout cleaners as recommended by the manufacturer. Finally polish with clean, dry cloths.
- B. Epoxy grout shall be removed from tile surfaces immediately during grouting operations.
- C. Do not use acid or acid cleaners to clean glazed tile. Acid cleaning of unglazed tile shall not be done before 10 days after setting, and then only when approved by the tile manufacturer.
- D. Clean and seal all floor tile surfaces with product recommended by the manufacturer for each type of tile and anticipated traffic just prior to Substantial Completion.

3.07 PROTECTION

- A. Do not permit traffic over finished floor surfaces for at least 4 days after installation is completed. Protect installed tile work as recommended by the manufacturer during construction to prevent damage.

END OF SECTION

**SECTION 09 51 00
ACOUSTICAL CEILINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical tiles.

1.02 RELATED REQUIREMENTS

- A. Section 07 90 05 - Joint Sealers: Acoustical sealant.
- B. Section 09 21 16 - Gypsum Board Assemblies: Drywall soffits.
- C. Division 21 - Fire Suppression.
- D. Division 23 - HVAC.
- E. Division 26 - Electrical.
- F. Division 27 - Communications.
- G. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.03 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.
- C. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2022.
- D. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2019.
- E. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions 2022.
- F. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2022.
- G. UL (GGG) - GREENGUARD Gold Certified Products Current Edition.

1.04 REGULATORY REQUIREMENTS

- A. All products and materials must be approved for sale in and meet local, State, and Federal regulations.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on suspension system components and acoustical units.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- D. Samples:
 - 1. Submit two samples 4x4 inch minimum in size, of selected acoustical tiles.
 - 2. Submit one samples 8 inches minimum long, of suspension system main runner.
- E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of Project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Acoustical Tiles: Quantity equal to 5 percent of total installed.

3. Extra stock shall match products installed and shall be packaged in protective covers for storage and identified with labels describing contents. Store as directed by the Owner. Send written notice to the Architect identifying the quantity and location of extra tile furnished. The tile shall not be used by the Contractor for corrective work during the warranty period.

1.06 QUALITY ASSURANCE

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Acoustical Tile Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum fifteen years documented experience.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Ceiling systems designed to withstand the effects of earthquake motions determined according to ASCE 7 for Seismic Design Category C and complying with the following:

2.02 ACOUSTICAL TILES

- A. Acoustical Tiles - General: ASTM E1264, Class A.
 1. VOC Content: Certified as Low Emission by one of the following:
 - a. Product listing in UL (GGG).
- B. Basis of Design Manufacturer:
 1. Armstrong World Industries, Inc.
 2. Acceptable Substitute Manufacturers: Substitute product must provide an equal or greater NRC Value and Ceiling Articulation Class (CAC), sag resistance, matching color, and a similar appearance to the Basis of Design ceiling tile.
 - a. Rockfon North America.
 - b. Certainteed, Saint Gobain.
 - c. USG Corporation.
 - 1) All substitutions must be submitted to Architect during bidding for Architect and Owner approval.
 - 2) Substitutions: See Section 01 60 00-Product Requirements.
- C. Acoustical Panels, Types ACT-1: Mineral fiber with membrane-faced overlay, with the following characteristics:
 1. Classification: ASTM E1264 Type A.
 - a. Form: A2.2, water felted.
 - b. Pattern: "E" - lightly textured.
 2. Size: 24 by 24 inches.
 3. Thickness: 7/8 inch.
 4. Light Reflectance: 87 percent, determined in accordance with ASTM E1264.
 5. NRC Range: 0.80, determined in accordance with ASTM E1264.
 6. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
 7. Panel Edge: Square Lay-in.
 8. Color: White.
 9. Suspension System: Type 1.
 10. Products:
 - a. Armstrong World Industries, Inc; Ultima 1940.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Acoustical Panels, Type ACT-2: Mineral fiber with membrane-faced overlay, with the following characteristics:
 1. Classification: ASTM E1264 Type B.

- a. Form: B2, water felted.
 - b. Pattern: "E" - lightly textured.
2. Size: 24 by 48 inches.
3. Thickness: 3/4 inch.
4. Light Reflectance: 88 percent, determined in accordance with ASTM E1264.
5. NRC Range: 0.90, determined in accordance with ASTM E1264.
6. Panel Edge: Square Lay-in.
7. Color: White.
8. Suspension System: Type 1.
9. Products:
 - a. Armstrong World Industries, Inc; Optima 3151.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 SUSPENSION SYSTEMS

- A. Manufacturers:
 1. Same as for acoustical tiles.
- B. Suspension Systems - General: Complying with ASTM C635; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.
 1. Materials:
 - a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.
- C. Exposed Suspension System, Type 1: Hot-dipped galvanized steel grid with steel cap.
 1. Structural Classification: Heavy-duty, when tested in accordance with ASTM C635/C635M.
 2. Profile: Tee; 15/16 inch face width.
 3. Finish: Baked enamel.
 4. Color: White, typical. Color match acoustical panels where noted on Drawings.
 5. Basis of Design Products:
 - a. Armstrong World Industries, Inc.; Prelude XL.
 - b. Substitutions: See Section 01 60 00-Product Requirements.

2.04 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
 1. Hanger wire: Galvanized soft temper, pre-stretched steel wire, per ASTM A641, with yield strength of at least 3 times design load, but not less than 12-gauge diameter.
- B. Hold-Down Clips: Manufacturer's standard clips to suit application. Install in vestibule ceilings and ceilings within ten feet of exterior doors.
- C. Mesh Lay-in Panels: Metal mesh lay-in panels, finish and pattern as indicated on Finish Legend:
 1. Product: Armstrong World Industries, Inc.; Mesh Lay-in.
- D. Perimeter Moldings: Same material and finish as grid, size suitable for suspension system and ceiling unit profile. Molding shall be suitable for use in fire-rated ceiling systems.
 1. Size: As required for installation conditions and specified Seismic Design Category.
 2. Angle Molding: L-shaped, for mounting at same elevation as face of grid.
 3. Acoustical Sealant For Perimeter Moldings: Non-hardening, non-skinning, for use in conjunction with suspended ceiling system. Specified in Section 07 90 05.
- E. Metal Edge Trim for Suspension Systems: Steel or extruded aluminum; provide attachment clips, splice plates, and preformed corner pieces for complete trim system.
 1. Trim Height: As indicated on drawings.
 2. Finish: Baked enamel.

- 3. Color: White.
- 4. Products:
 - a. AXIOM by Armstrong World Industries..
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Gypsum Board: Specified in Section 09 21 16.
- G. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Verify that layout of hangers will not interfere with other work.
- C. Any questions or conflicts shall be brought to the attention of the Architect prior to proceeding with the Work.

3.02 PREPARATION

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C 636/C 636M, ASTM E 580/E 580M, and manufacturer's instructions and as supplemented in this Section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Install in bed of acoustical sealant.
 - 2. Use longest practical lengths.
- D. Provide hanger clips during steel deck erection. Do not support ceiling directly from steel roof deck or tabs. Provide additional hangers and inserts as required. Connect hanger wires directly either to structure, or to inserts, eye screws or other devices that are secure and appropriate for the substrate. All hangers and supports shall be secured in such a way that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
- E. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Install hangers plumb. Angle hangers only where required to miss obstructions. Any non-plumb hangers that result in horizontal forces shall be braced. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- F. Seismic Suspension System, Seismic Design Category C: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Maintain a 3/8 inch clearance between grid ends and wall.
- G. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three (3) tight turns. Secure bracing wire to ceiling suspension members and to supports with a minimum of four (4) tight turns.
- H. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance. Alternatively, install supplemental suspension members and hangers in the form of trapeze or equivalent devices, sized to support ceiling loads.
- I. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

- J. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
 - 1. Provide supplemental supports for grid where cubicle curtain tracks and I.V. tracks are attached to grids shall support a vertical test load of 50 lbs without visible deflection or damage to supports and safely support moving loads.
- K. Do not eccentrically load system or induce rotation of runners.
- L. Provide additional hangers for the suspension system at each corner of light fixtures if independent support of fixtures is not provided by Division 26 - Electrical. All light fixtures in excess of 56 lb shall be independently supported.
- M. Provide additional hangers for air terminal units or services weighing more than 20 lb but less than 56 lb in addition to positively attaching them to the ceiling suspension system. Units weighing more than 56 lb shall be independently supported to the building structure.
- N. Walls or partitions attached to ceiling systems shall be provided with lateral bracing independent of the ceiling system unless ceiling system to partition connections and bracing is engineered to support the reaction force of the partition from the prescribed loads applied perpendicularly to the partitions. Partition attachment to the ceiling system shall allow lateral movement of the ceiling system.
- O. Provide framing for recessed light fixtures, air outlets, diffusers, etc. See Architectural, Mechanical, and Electrical Drawings.
- P. Expansion Joint Moldings: Install at intersection of ceilings and firewalls, building expansion joints, and where indicated on the Drawings.
- Q. Form expansion joints as recommended by the manufacturer. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.
- R. Install light fixture boxes constructed of gypsum board above light fixtures in accordance with fire rated assembly requirements and light fixture ventilation requirements.
- S. Where approved by the Architect and where field conditions require lowering a portion of a ceiling to conceal piping or ductwork, the ceiling contractor shall provide a ceiling height change and transition at no additional cost to the Owner.

3.04 INSTALLATION - SUSPENSION SYSTEM SEISMIC REQUIREMENTS

- A. Provide suspension, bracing, and attachments in strict accordance with ASCE 7, current edition, ASTM C635, ASTM C636 and CISCRA Recommendations For Direct-Hung Acoustical Tile and Lay-in Panel Ceilings, most recent edition. The requirements for seismic bracing shall generally include, but not be limited to the following features:
 - 1. For Seismic Design Categories A, B and C: CISCRA requirements for Seismic Zones 0-2 and provisions in ASCE 7 Section 13.5.6.2.1.
 - a. For spaces less than 144 sq. ft. in size, no seismic restraint is required.
 - b. For spaces 144 sq. ft. and greater in size, in general provide:
 - 1) The total weight of the suspension system (grid), tiles, and other ceiling components (light fixtures, air terminals, etc) shall be no greater than 2.5 PSF, or other ceiling components shall be independently supported.
 - 2) The suspension system (grid) shall be designed, tested, and rated for ultimate load capacity as per ASCE 7.
 - 3) All sides of the space shall have tees cut back 3/8" at the perimeter to accommodate movement and shall not be attached to the perimeter molding. Perimeter moldings shall provide a minimum supporting ledge of 7/8" for tees or all tees shall be independently supported within 8" of the perimeter. All ends of main runners and cross members shall be tied together or shall have stabilizer/spacer bars attached to members to prevent spreading. Permanent attachment (i.e. pop rivets) for grid alignment shall not be permitted.

- 4) Openings for sprinkler heads shall provide a minimum of 1/4" clearance on all sides of the piping. All other ceiling penetrations shall provide a minimum of 3/8" clearance.

3.05 INSTALLATION - ACOUSTICAL TILES

- A. Owner's Inspection: All areas above suspended ceilings shall be inspected by the Owner prior to installation of ceiling tiles. The Contractor shall obtain written permission from the Owner to proceed with ceiling tile installation. Failure to follow this procedure shall result in removal and reinstallation of ceiling panels to facilitate inspection at no additional cost to the Owner.
- B. Install acoustical tiles in accordance with manufacturer's instructions.
- C. Fit acoustical tiles in place, free from damaged edges or other defects detrimental to appearance and function.
- D. Provide 24 by 48 tiles at limited locations to avoid an additional grid member with 6 inches of perimeter angle.
- E. Lay directional patterned tiles with pattern parallel to longest room axis.
- F. Fit border trim neatly against abutting surfaces.
- G. Install tiles after above-ceiling work is complete. Do not install tile until mechanical and electrical systems are tested and complete and all firestopping and smoke seals have been inspected and accepted.
- H. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- I. Cutting Acoustical Tile:
 1. Cut to fit irregular grid and perimeter edge trim.
 2. Make field cut edges of same profile as factory edges.
 3. Double cut and field paint exposed reveal edges.
- J. Where round obstructions occur, provide preformed closures to match perimeter molding.
- K. Install hold-down clips on tiles within 10 ft of an exterior door, at sloped and vertical installation to secure tile and as otherwise indicated. Space clips per manufacturer's recommendations.
- L. Install safety clips on wood veneer panels 2 inches from outside edge of panel and at 24 inches on center.
 1. Use wire ties to attach safety clips.

3.06 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.07 CLEANING

- A. Clean soiled exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members as recommended by the manufacturer. Remove and replace damaged ceiling components that cannot be successfully cleaned and repaired.

END OF SECTION

**SECTION 09 65 00
RESILIENT FLOORING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient sheet flooring.
- B. Resilient tile flooring.
- C. Resilient base.
- D. Installation accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 54 00 - Cast Underlayment.
- B. Section 09 05 61 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation. Concrete slab moisture and alkalinity testing and remediation procedures.
- C. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.03 REFERENCE STANDARDS

- A. ASTM E492 - Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine; 2025.
- B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2025.
- C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2022.
- D. ASTM F970 - Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading; 2022.
- E. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2025.
- F. ASTM F1859 - Standard Specification for Rubber Sheet Floor Covering Without Backing 2021a.
- G. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021 (Reapproved 2025).
- H. ASTM F1913 - Standard Specification for Vinyl Sheet Floor Covering Without Backing; 2019 (Reapproved 2025).
- I. ASTM F2169 - Standard Specification for Resilient Stair Treads; 2015 (Reapproved 2025).
- J. ASTM F3261 - Standard Specification for Resilient Flooring in Modular Format with Rigid Polymeric Core; 2020.
- K. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

1.04 REGULATORY REQUIREMENTS

- A. All products and materials must be approved for sale in and meet local, State, and Federal regulations.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.

- D. Shop Drawings: Indicate seaming plan for all sheet goods. All proposed seams shall be indicated. Installation shall not begin prior to the Architect's review and acceptance
- E. Verification Samples: Submit two samples, 12 by 12 inch in size illustrating color and pattern for each resilient flooring product specified.
- F. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- G. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.
- H. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Flooring Material: 10 square feet of each type and color.
 - 3. Extra Wall Base: 10 linear feet of each type and color.
 - 4. Materials shall be in provided in unbroken packaging when job is complete. Notify the Architect in writing of the quantity and location of materials furnished. These materials may not be used by the Contractor for corrective work during the warranty period.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.
- C. All vinyl composition products shall be by a single manufacturer. All rubber products shall be by a single manufacturer, and all linoleum shall be by a single manufacturer unless otherwise directed or approved by the Architect.
- D. All colors shall match as directed by the Architect and shall be from the same "color run" or "dye lot".

1.07 PRE-INSTALLATION MEETING

- A. Convene a pre-installation meeting after the results of slab testing are available and at least one week before starting work of this Section; require attendance by the Contractor, a technical representative from each flooring manufacturer, flooring installer, Architect and Owner, to review slab moisture levels, floor surface conditions, temperature and preparation requirements, ambient temperature and relative humidity during and after installation, materials, installation procedures and coordination of related work.
 - 1. A field report summarizing the findings and recommendations from this meeting shall be issued by the technical representatives and copied to the Owner and Architect.
 - 2. Written certification from each flooring manufacturer that condition of sub-floor is acceptable for flooring installation shall be issued and copied to the Owner and Architect.
 - 3. If a slab sealer or other remedial work is required to make the condition of the sub-floor acceptable for the flooring installation, slab preparation and slab sealer product installation shall be field reviewed by the manufacturer's technical representatives and application tested (thickness, adhesion, etc) to confirm compliance with product recommendations.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Protect roll materials from damage. Store roll material as directed by the manufacturer. All resilient flooring materials shall be stored in undamaged condition as packaged by the manufacturer, with manufacturer's seals and labels in tact.

- D. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- E. Do not double stack pallets.

1.09 FIELD CONDITIONS

- A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain ambient and floor slab conditions at 60 degrees F and above. Slab and ambient conditions shall be monitored.

1.10 WARRANTY

- A. See Section 01 78 10 - Warranties, for additional requirements.
- B. Provide manufacturer's product warranty. See product listing for term.

PART 2 PRODUCTS

2.01 GENERAL

- A. Resilient Flooring – General:
 - 1. VOC Content: Certified as Low Emission by one of the following:
 - a. Product listing in UL (GGG).
- B. Basis of Design Manufacturer:
 - 1. As Indicated on Finish Legend.
 - a. All substitutions must be submitted to Architect during bidding for Architect and Owner approval.
 - b. Substitutions: See Section 01 60 00-Product Requirements.

2.02 SHEET FLOORING

- A. Vinyl Sheet Flooring - Type RF-1 & RF-2: Homogeneous without backing, with color and pattern throughout full thickness.
 - 1. Minimum Requirements: Comply with ASTM F1913.
 - 2. Critical Radiant Flux (CRF): Minimum 0.22 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
 - 3. Thickness: 0.080 inch nominal.
 - 4. Sheet Width: 78 inch minimum.
 - 5. Static Load Resistance: 2000 psi minimum, when tested as specified in ASTM F970.
 - 6. Seams: Heat welded.
 - a. Welding Rod: Solid bead in material compatible with flooring, produced by flooring manufacturer for heat welding seams, and in color matching field color.
 - 7. Color: As indicated on drawings.
 - 8. Basis of Design Product:
 - a. Mannington; Biospec MD.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 TILE FLOORING

- A. Vinyl Composition Tile – Type RF-3 & RF-4: Homogeneous, with color extending throughout thickness.
 - 1. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
 - 2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
 - 3. Size: 12 by 12 inch.
 - 4. Thickness: 0.125 inch.
 - 5. Pattern: Match Existing.
 - 6. Color: As indicated on drawings.
 - 7. Basis of Design Product:

- a. Armstrong Flooring; Excelon SDT.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Resilient Tile with Rigid Polymeric Core - Type RF-5: Printed film type, with transparent or translucent wear layer; polymeric rigid core with or without backing.
 - 1. Minimum Requirements: Comply with ASTM F3261, Class I; Type A - Smooth; Grade 1 - Commercial.
 - 2. Backing Class: Class A - No backing.
 - 3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648.
 - 4. Plank Tile Size: 6 by 36 inches.
 - 5. Wear Layer Thickness: 0.020 inch.
 - 6. Total Thickness: 0.120 inch.
 - 7. Tile Edge: Straight.
 - 8. Color: As indicated on drawings.
 - 9. Basis of Design Product:
 - a. Tarkett; iD Latitude Wood.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 RESILIENT BASE

- A. Resilient Base - Type RB-1: ASTM F1861, Type TS, rubber, vulcanized thermoset; style as scheduled.
 - 1. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
 - 2. Height: 4 inches.
 - 3. Thickness: 0.125 inch.
 - 4. Finish: Satin.
 - 5. Length: Roll.
 - 6. Color: See Finish Legend.
 - 7. Adhesive: As recommended by the base manufacturer.
 - 8. Warranty: Two years.
 - 9. Color: To be selected by Architect from manufacturer's full range.
 - 10. Basis of Design Product:
 - a. Roppe; Pinnacle Rubber Base.
 - b. Acceptable Substitute Products:
 - 1) Tarkett USA, Inc; Baseworks Wall Base.
 - 2) Substitutions: See Section 01 60 00 - Product Requirements.

2.05 ACCESSORIES

- A. Subfloor Patching Compounds: See Section 09 05 61 - Common Work Results for Flooring Preparation.
- B. Slab Moisture Barrier System: See Section 09 05 61 - Common Work Results for Flooring Preparation.
- C. Self-Leveling Underlayment: See Section 03 54 00 - Cast Underlayment.
- D. Primers, Adhesives, and Seaming Materials: Waterproof; low VOC types, as required to provide bonding for measured slab porosity; recommended by flooring manufacturers.
 - 1. Adhesive capable of bonding to high moisture content concrete slabs shall be provided as recommended by the flooring manufacturer. Provide manufacturer's recommended adhesives to meet the following minimum requirements:
 - a. ASTM F1869 – up to 10 lbs.
 - b. ASTM F2170 – up to 95% RH.

- 1) For flooring type RF-3 & RF-4, provide manufacturer's recommended adhesive with no limitation based on slab moisture testing. Testing of substrate is still required in accordance with Section 09 05 61.
 - (a) Product: Armstrong Flooring: S-1000 Adhesive.
- E. Filler for Coved Base: Plastic.
- F. Flooring Transitions:
 1. At resilient flooring to resilient flooring transition: No transition strip. Use scribing felt at unequal thickness products.
 2. Colors and Finishes: See Finish Legend.
 3. Products: See Finish Legend.
- G. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 GENERAL

- A. Floor tile pattern layouts shall be as designed by the Architect. Flooring shall be placed so that fields or patterns center on area. The Architect shall select the pattern (direction of grain) to be used.
- B. For renovations, thoroughly inspect all of the Contract Documents and provide resilient flooring and base patching to match existing adjacent materials throughout the building.
- C. Base shall be continuous as scheduled unless otherwise approved by the Architect. Base shall return to door or window frames at all openings.
- D. Unless otherwise approved by the Architect, flooring materials shall extend below fixed casework and millwork to cover the entire floor areas. Where integral base is provided, it shall extend behind casework to form a watertight base.
- E. Work shall not be started until work of other trades, which goes through resilient flooring, has been completed.

3.02 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
 1. Test in accordance with Section 09 05 61.
 2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
 3. Follow moisture and alkalinity remediation procedures in Section 09 05 61.
- C. Verify that required floor-mounted utilities are in correct location.
- D. Any conditions that could adversely affect the flooring installation shall be corrected, prior to proceeding with the Work. Commencement of the installation of flooring shall be considered acceptance of the concrete slab as being suitable for the intended application. Any conditions that could adversely affect the flooring installation shall be brought to the Contractor's attention, for resolution, prior to proceeding with the Work.

3.03 PREPARATION

- A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

3.04 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.

- C. Adhesive-Applied Installation:
 - 1. Spread only enough adhesive to permit installation of materials before initial set.
 - 2. Fit joints and butt seams tightly.
 - 3. Set flooring in place, press with heavy roller to attain full adhesion.
- D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- E. Install terminations as indicated. In general, flooring substrates shall be feathered to provide a level transition between flooring surfaces without transition strips.
- F. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
 - 1. Metal Strips: Attach to substrate before installation of flooring using stainless steel screws.
 - 2. Resilient Strips: Attach to substrate using adhesive.
- G. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.05 INSTALLATION - SHEET FLOORING

- A. Lay flooring in accordance with accepted seaming shop drawings.
- B. Flooring shall be laid continuously wall-to-wall, without joints, unless specifically accepted by the Architect prior to installation. Seams are prohibited in bathrooms, kitchens, toilet rooms, and custodial closets.
- C. In general, lay flooring with seams parallel to longer room dimensions, to produce minimum number of seams. Lay out seams to avoid widths less than 1/3 of roll width; match patterns carefully at seams.
- D. Seal seams by heat welding where indicated.
- E. Seal flooring into floor drains as required
- F. Coved Base: Install as detailed on drawings, using coved base filler as backing at floor to wall junction. Extend sheet flooring vertically to height indicated, and cover top edge with metal cap strip.

3.06 INSTALLATION - TILE FLOORING

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.
- C. Install square tile to ashlar pattern. Allow minimum 1/2 full size tile width at room or area perimeter.

3.07 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints. Install wall base in lengths as long as without gaps at seams and with tops of adjacent pieces aligned. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- B. Miter internal corners. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions. Install base on all built-in cabinets, locker bases, etc., unless specifically indicated otherwise. Base shall extend around all sides of cabinetwork.

3.08 INSTALLATION - STAIR COVERINGS

- A. Install stair coverings in one piece for full width and depth of tread.

- B. Install stringers configured tightly to stair profile.
- C. Adhere over entire surface. Fit accurately and securely.

3.09 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field quality control and inspection.
- B. Manufacturer's Inspections: Following the requirements for pre-installation field meeting and sub-floor preparations for the flooring installation, inspections shall be made by technical representatives of each flooring system manufacturer at the following points in the flooring installation:
 - 1. First, early in the installation process to ascertain that flooring procedures and details discussed at the pre-construction meeting are being followed.
 - 2. Second, at the completion of the installation, to review the completed installation. Manufacturer's technical representative's field reports for each site visit shall be copied to the Owner and Architect.

3.10 CLEANING

- A. Immediately after installation, remove excess adhesive and other blemishes from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.
- C. When installation is complete and after resilient floor materials have set for four to five days, or as recommended by the flooring manufacturer, but not sooner than four days prior to inspection for Substantial Completion, scrub and rinse floors thoroughly.
- D. Promptly correct work rejected by the Architect.

3.11 WAXING

- A. Wax vinyl composition tiles in accordance with manufacturer recommendations.

3.12 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation. Protect flooring against marks and damage from construction operations utilizing methods recommended by the flooring manufacturer. Cover tiles with undyed building paper until inspection for Substantial Completion.

END OF SECTION

**SECTION 09 68 13
TILE CARPETING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Carpet tile, fully adhered.
- B. NOTE: All flooring transitions shall provide smooth floor surfaces, with no abrupt elevation change.

1.02 RELATED REQUIREMENTS

- A. Section 09 05 61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.
- B. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.03 REFERENCE STANDARDS

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials 2016 (Reapproved 2021).
- B. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2023.

1.04 REGULATORY REQUIREMENTS

- A. All products and materials must be approved for sale in and meet local, State, and Federal regulations.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- D. Samples:
 - 1. Submit carpet tiles illustrating color and pattern design for each carpet color selected.
- E. Manufacturer's Installation Instructions: Indicate special procedures.
- F. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- G. Certification and Field Reports:
 - 1. Prior to installation of flooring, submit written certification by each flooring manufacturer that condition of sub-floor is acceptable.
 - 2. Submit copies of manufacturer's technical representative's field reports for each field visit.
- H. Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum ten years documented experience.
- B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.07 PRE-INSTALLATION MEETING

- A. Convene a pre-installation meeting at least one week before starting work of this Section; require attendance by the Contractor, a technical representative from each carpet manufacturer, carpet installer, Architect and Owner, to review slab moisture levels, floor surface conditions and preparation requirements, materials, installation procedures and coordination of related work.
 - 1. A field report summarizing the findings and recommendations from this meeting shall be issued by the technical representatives and copied to the Owner and Architect.
 - 2. Written certification from each carpet manufacturer that condition of sub-floor is acceptable for flooring installation shall be issued and copied to the Owner and Architect.

1.08 FIELD CONDITIONS

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Carpet Tiles – General:
 - 1. VOC Content: Certified as Low Emission by one of the following:

2.02 MATERIALS

- A. Tile Carpeting, Type FC-1: Tufted textured loop, manufactured in one color dye lot.
 - 1. Critical Radiant Flux, ASTM E648 or NFPA 253: Minimum of 0.45 watts/sq cm.
 - 2. Surface Flammability Ignition, ASTM D2859: Pass ("pill test").
 - 3. Dye Method: 100% Solution Dyed.
 - 4. Tile Size: 19.7 by 19.7 inch, nominal.
 - 5. Pile Height: 0.122 inch.
 - 6. Pile Density: 7,953 oz/cu yd.
 - 7. Pattern: Non-directional.
 - 8. Color: See Finish Legend.
 - 9. Critical Radiant Flux, ASTM E648 or NFPA 253: Minimum of 0.45 watts/sq cm.
 - 10. Surface Flammability Ignition, ASTM D2859: Pass ("pill test").
 - 11. Basis of Design Product:
 - a. Interface; Come and Go.
 - b. Substitutions: See Section 01 60 00-Product Requirements.
 - 1) All substitutions must be submitted to Architect during bidding for Architect and Owner approval.

2.03 ACCESSORIES

- A. Sub-Floor Filler and Leveler: See Section 09 05 61 and as recommended by flooring manufacturer.
- B. Transition Strips: See Finish Legend.
- C. Subfloor Patching Compounds: See Section 09 05 61 - Common Work Results for Flooring Preparation.
- D. Primers, Adhesives, and Seaming Materials: Waterproof; low VOC types, as required to provide bonding for measured slab porosity; recommended by flooring manufacturers.
 - 1. Adhesive capable of bonding to high moisture content concrete slabs shall be provided as recommended by the flooring manufacturer. Provide manufacturer's recommended adhesives to meet the following minimum requirements:
 - a. ASTM F1869 – up to 10 lbs
 - b. ASTM F2170 – up to 95% rh

PART 3 EXECUTION

3.01 EXAMINATION

- A. Acceptance by Carpet Subcontractors: The carpet installer shall inspect the condition of substrates prior to commencement of work and shall notify the Contractor immediately of any conditions that could adversely affect the carpet installation for resolution, prior to proceeding with the Work. Commencement of the installation of flooring without such notification shall be considered acceptance of the adequacy of the substrates and carpet installation environment as being suitable for the intended application
- B. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.
- D. Owner's testing agency shall test concrete slab surfaces prior to installation of any flooring. Test results shall be made available to the contractor for determination of acceptability by the flooring and adhesives manufacturers. Contractor shall obtain instructions from flooring manufacturers if test results are not within their recommendation limits. Testing shall include
- E. Owner's testing agency shall test concrete slab surfaces prior to installation of any flooring. Test results shall be made available to the contractor for determination of acceptability by the flooring and adhesives manufacturers. Contractor shall obtain instructions from flooring manufacturers if test results are not within their recommendation limits. See Section 09 05 61 – Common Work Result for Flooring Preparation.
- F. If remedial work is recommended by the flooring and adhesive manufacturers, the preparation for and installation of moisture control coatings shall be inspected by the product manufacturer's technical representative and tested for adequacy by the Owner's testing agency prior to resumption of the flooring installation.

3.02 PREPARATION

- A. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.
- B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- C. Vacuum clean substrate.

3.03 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions.
- C. Blend carpet from different cartons to ensure minimal variation in color match.
- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- E. Lay carpet in pattern indicated in the Finishes Legend.
- F. Locate change of color or pattern between rooms under door centerline.
- G. Trim carpet tile neatly at walls and around interruptions.
- H. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

- A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- B. Clean and vacuum carpet surfaces.

END OF SECTION

**SECTION 09 72 00
WALL COVERINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation and prime painting.
- B. Wall covering.

1.02 RELATED REQUIREMENTS

- A. Section 09 21 16 - Gypsum Board Assemblies: Wall substrate.
- B. Section 09 91 23 – Interior Painting: Preparation and priming of substrate.
- C. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.03 REFERENCE STANDARDS

- A. ASTM D1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Coating Systems 2020.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023b.
- C. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics 2020.

1.04 REGULATORY REQUIREMENTS

- A. All products and materials must be approved for sale in and meet local, State, and Federal regulations.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on wall coverings, accessories and adhesive.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- D. Shop Drawings: Indicate wall elevations with seaming layout.
- E. Samples: Submit confirmation samples of wall covering, 12 x 12 inch in size illustrating selected colors, finishes, and textures.
- F. Test Reports: Indicate verification of flame and smoke ratings, when tested by UL.
- G. Manufacturer's Installation Instructions: Indicate special procedures.
- H. Maintenance Data: Submit data on cleaning, touch-up, and repair of covered surfaces.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Wall Covering Materials: 10 linear feet of each color and pattern of wall covering; store where directed.
 - 3. Package and label each roll by manufacturer, color and pattern, and destination room number.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this Section with minimum ten years of experience.
- B. Installer Qualifications: Company specializing in performing the type of work specified in this Section with minimum five years of experience and installer shall be qualified in textile installations.

1.07 MOCK-UPS

- A. Provide panel, minimum 3 panel drops wide, full height, illustrating installed wall covering and joint seaming technique and finished painted as applicable. Mock-up shall demonstrate level of workmanship for the Project. Remove rejected mock-ups. Make corrections required to achieve acceptance by the Architect.
- B. Locate where directed.
- C. Accepted mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Inspect roll materials at arrival on site, to verify acceptability.
- B. Protect packaged adhesive from temperature cycling and cold temperatures.
- C. Do not store roll goods on end.

1.09 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or wall covering product manufacturer.
- B. Maintain these conditions 24 hours before, during, and after installation of adhesive and wall covering.
- C. Provide lighting level of 80 ft candles measured mid-height at substrate surfaces. Maintain continuous ventilation and heating for air and substrate surfaces above 55 degrees F and less than 40% relative humidity.

PART 2 PRODUCTS

2.01 WALL COVERINGS

- A. General Requirements:
 - 1. Surface Burning Characteristics: Flame spread/Smoke developed index of 75/450, maximum, when tested in accordance with ASTM E84.
 - 2. Chemical and Stain Resistance: No visible staining or discoloration and no damage to surface texture when tested in accordance with ASTM D1308.
- B. Wall Covering, Type WC-1: Fabric-backed vinyl roll stock.
 - 1. Comply with ASTM F793/F793M, Category V, Type II.
 - 2. Products:
 - a. See Finish Legend.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.
- D. Substrate Primer and Sealer: As recommended by the wallcovering manufacturer, see Section 09 91 23 – Interior Painting.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are clean, sound, free of markings, prime painted and ready to receive work, and conform to requirements of the wall covering manufacturer.
- B. Measure moisture content of surfaces using an electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.
- C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet nor vary at a rate greater than 1/16 inch/ft.
- D. Report any deficiencies to the contractor for correction prior to starting installation of wall covering.

3.02 PREPARATION

- A. Fill cracks in substrate and smooth irregularities with filler; sand smooth.
- B. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.
- C. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- D. Wall substrate shall be prepared to meet Level 4 finish standard per GA-214-M. Test wall surface to determine acceptable moisture content.
- E. Surfaces: Correct defects and clean surfaces that affect work of this section.
- F. Apply one coat of primer sealer to substrate surfaces. See section 09 91 23 – Interior Painting for application requirements. Allow to dry. Lightly sand smooth.
- G. Vacuum clean surfaces free of loose particles.

3.03 INSTALLATION

- A. Apply adhesive and wall covering in accordance with manufacturer's instructions.
- B. Apply adhesive to wall surface immediately prior to application of wall covering.
- C. Acoustic Wallcovering: Hang panels dry and straight up. All edges shall be butt joined. Panels shall not be reversed.
- D. Razor trim edges on flat work table. Do not razor cut on gypsum board surfaces.
- E. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface.
- F. Butt edges tightly.
- G. Horizontal seams are not acceptable.
- H. Do not seam within 2 inches of internal corners or within 6 inches of external corners.
- I. Do not install wall covering more than 1/4 inch below top of resilient base.
- J. Cover spaces above and below windows, above doors, in pattern sequence from roll.
- K. Install termination trim.
- L. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

3.04 CLEANING

- A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.
- B. Reinstall wall plates and accessories removed prior to work of this section.

3.05 PROTECTION

- A. Do not permit construction activities at or near finished wall covering areas.

END OF SECTION

**SECTION 09 91 23
INTERIOR PAINTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. All necessary surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
 - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
 - 2. Prime surfaces to receive wall coverings.
 - 3. Mechanical and Electrical:
 - a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
 - b. In finished areas, paint shop-primed items.
 - c. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
 - d. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
- D. Field testing for substrate moisture content and alkalinity.
- E. Field testing compatibility of new paint with shop-applied primers, existing paint or finishes to be covered.
- F. Painting of stenciled signs above accessible ceilings for fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions.
- G. The painting subcontractor shall examine all the Sections of the Specifications and shall thoroughly familiarize himself with all their provisions regarding painting and finishing.
 - 1. All surfaces that are primed or left unfinished by the requirements of other Sections of the Specifications shall be painted or finished as a part of this Section, unless specifically indicated otherwise.
 - 2. Areas of new patches in existing construction shall be painted or finished, and where not scheduled, shall match the existing finish.
- H. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
 - 6. Marble, granite, slate, and other natural stones.
 - 7. Floors, unless specifically indicated.
 - 8. Ceramic and other tiles.
 - 9. Glass.
 - 10. Acoustical materials, unless specifically indicated.
 - 11. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 05 51 00 - Metal Stairs and Railings.
- B. Section 08 11 13 – Hollow Metal Doors and Frames.
- C. Section 09 21 16 – Gypsum Board Assemblies.
- D. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.03 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REGULATORY REQUIREMENTS

- A. All products and materials must be approved for sale in and meet local, State, and Federal regulations.

1.05 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2023.
- C. CARB (SCM) – Suggested Control Measures for Architectural Coatings; California Air Resources Board; 2020.
- D. MPI (APL) – Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.
- E. SCAQMD 1113 – Architectural Coatings; 1977, with Amendment (2016).
- F. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).
- G. SSPC-SP 2 - Hand Tool Cleaning 2018.
- H. SSPC-SP 6 - Commercial Blast Cleaning 2007.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
 - 2. MPI product number (e.g., MPI #47).
 - 3. Cross-reference to specified paint system products to be used in project; include description of each system.
- C. Samples: Submit paper chip samples, 4 by 4 inch in size illustrating colors selected for each product scheduled.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures.
- F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Paint and Finish Materials: 1 gal of each color; from the same product run, store where directed.
 - 3. Label each container with color in addition to the manufacturer's label.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum fifteen years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience and with minimum five years experience.

1.08 PRE-INSTALLATION MEETING

- A. A pre-installation meeting shall be held at the jobsite, including: Contractor, painting subcontractor, paint manufacturer's technical representative, Owner's representative and Architect. The purpose of the meeting shall be to review existing conditions. The paint manufacturer's technical representative shall perform an on-site inspection to confirm compatibility and suitability of specified materials, following which he shall provide written certification that all materials specified are entirely suitable for their proposed applications.

1.09 MOCK-UP

- A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.
- B. Provide a finished sample room, complete or in part, with all finish items completed in accordance with the Specification and in selected colors. Items not accepted shall be re-finished. When accepted, they shall serve as a standard for workmanship, appearance and materials for similar areas throughout this Project.
- C. Accepted mock-up may remain as part of the work.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.11 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.
- D. Provide lighting level of 80 fc measured mid-height at substrate surface.
- E. The Owner and all subcontractors shall be kept informed of the use of products that may generate fumes in advance of the use of such products.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
 - 1. Basis of Design: Sherwin-Williams Company (and Wolf Gordon where indicated).
 - 2. Acceptable Manufacturers:
 - a. Benjamin Moore
 - b. Glidden Professional.
 - c. PPG Paints.

d. Substitutions: See Section 01 60 00 - Product Requirements.

C. Primer Sealers: Same manufacturer as top coats.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. Primers: As follows unless other primer is required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
4. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
5. Supply each paint material in quantity required to complete entire project's work from a single production run.
6. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:

1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - b. Architectural coatings VOC limits of the State in which the Project is located.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

D. Colors: See Finish Legend.

1. Colors on Finish Legend may or may not match specified Basis of Design paint manufacturer. Paint colors to color match manufacturer colors on Finish Legend, requiring custom colors.
2. Extend colors to surface edges; colors may change at any edge as directed by Architect.
3. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.

2.03 PAINT SYSTEMS - INTERIOR

A. Metal, Ferrous: Water-based Alkyd:

1. Applications: Interior hollow metal doors and frames, handrails, and guardrails.
 - a. Semi-Gloss Finish:
 - 1) 1st Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series, MPI #107.
 - (a) 5 mils wet, 2 mils dry per coat.
 - 2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Water Based Alkyd Urethane Enamel Semi-Gloss, B53-1150 Series.
 - (a) 4 to 5 mils wet, 1.4 to 1.7 mils dry per coat.

B. Metal, Galvanized/Aluminum: Water-based Alkyd:

1. Applications: Misc metals and metals in services spaces.
 - a. Semi-Gloss Finish:

- 1) 1st Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series, MPI #107.
(a) 5 mils wet, 2 mils dry per coat.
 - 2) 2nd and 3rd Coat: Sherwin-Williams ProMar 200 Zero VOC Latex Eggshell, B31 Series, MPI #43.
(a) 4 mils wet, 1.6 mils dry per coat.
- C. Gypsum Board, to receive protection panel or wall coverings; 1 coat primer:
1. Application: Wall prep for wall protection panels and wall coverings. See Section 09 72 00 and 10 26 01.
 - a. 1st coat primer sealer.
 - 1) Verify primer compatibility with protection panel or wall covering manufacturer adhesives.
- D. Gypsum Board, Walls, Latex; 1 coat primer, 2 top coats:
1. Application: Typical gypsum board walls.
 - a. Eggshell Finish:
 - 1) 1st Coat: Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer, B28W2600, MPI #50.
(a) 4 mils wet, 1.5 mils dry per coat.
 - 2) 2nd and 3rd Coat: Sherwin-Williams ProMar 200 Zero VOC Latex Eggshell, B20 Series, MPI #44.
(a) 4 mils wet, 1.6 mils dry per coat.
- E. Gypsum Board, Walls, Epoxy, water-based; 1 coat primer, 2 top coats:
1. Eg-Shel/Low Luster Finish:
 2. Application: Gypsum board walls in the following locations:
 - 1) Toilet room walls.
 - 2) Other locations where indicated on Drawings/Finish Legend.
 - b. 1st Coat: Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer, B28W2600, MPI #50.
 - 1) 4 mils wet, 1.5 mils dry per coat.
 - c. 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45 Series, MPI #139.
 - 1) 4 mils wet, 1.5 mils dry per coat.
- F. Gypsum Board, Ceilings, Latex; 1 coat primer, 2 top coats:
1. Application: Typical gypsum board ceilings and soffits.
 - a. Flat Finish:
 - 1) 1st Coat: Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer, B28W2600, MPI #50.
(a) 4 mils wet, 1.5 mils dry per coat.
 - 2) 2nd and 3rd Coat: Sherwin-Williams ProMar 200 Zero VOC Latex Flat, B30-2600 Series, MPI #53.
(a) 4 mils wet, 1.6 mils dry per coat.

2.04 ACCESSORY MATERIALS

- A. Accessory Materials: Other materials not specifically indicated but required to achieve the finishes specified; commercial quality, "best grade" of "first line" made by reputable, recognized manufacturers, shall be compatible with related products and shall bear manufacturer's labels.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 WORKMANSHIP

- A. Employ skilled mechanics to ensure the very best workmanship. Quality workmanship is required. Materials shall be applied by craftsmen experienced in the use of the specific product involved.
- B. All materials shall be applied in strict accordance with the manufacturer's printed instructions.
- C. Finish work shall be uniform and of the approved color. Paint and stain shall completely cover, be smooth and free from runs, sags, clogging, excessive flooding, or brush marks. Make edges of paint and stain adjoining other materials or colors sharp and clean without overlapping.

3.02 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been adequately prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. Test shop-applied primer for compatibility with subsequent cover materials.
- E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
 - 1. Gypsum Wallboard: 12 percent.
 - 2. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.03 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. General: Do not begin painting on any surface until it is in proper condition to receive the paint or as specified. Should any surface be found unsuitable to produce a proper finish, the Architect and product manufacturer shall be notified in writing and no material shall be applied until the unsuitable surfaces have been made satisfactory.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. New Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound and sand to smooth level surface. Exercise care to avoid raising nap of paper. Spot prime defects after repair.
- G. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- H. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
 - 2. Prepare surface according to SSPC-SP 2.
- I. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3. Protect from corrosion until coated.

3.04 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Spray painting will not be allowed unless prior written approval is obtained from the Architect or unless application by spray painting is specifically called for at a particular surface. Where spray painting is allowed for wall surfaces, coats shall be back-rolled.
- C. Spray painted wall surfaces shall be back-rolled.
- D. No interior painting or finishing shall be permitted until the building has been thoroughly dried out. See Environmental Requirements for application air temperature requirements. Relative humidity shall be 75% maximum. Moisture levels for painting shall be within 5 degrees F of the dew point and shall be determined by use of an electronic moisture meter.
- E. The atmosphere shall be relatively free of airborne dust. Each coat of paint shall be applied smoothly, worked out evenly and allowed to dry completely before the subsequent coat is applied. Follow manufacturer's labeled instructions for drying time between coats
- F. Where open cabinets or shelves occur, room finish on walls shall not be omitted. However, painting on walls will not be required behind permanently built-in cabinets and lockers with closed backs.
- G. Hardwood millwork excluded from shop finishing, shall be fully field finished with a transparent finish.
- H. All closets shall be finished the same as adjoining rooms, unless otherwise indicated.
- I. All doors and frames shall have the same finish and number of coats on both interior and exterior sides. Do not paint over door and frame fire-rating labels.
- J. All exposed structures (columns, trusses, beams, joist, deck, etc.) shall be painted the same color selected by the Architect, unless specifically indicated otherwise.
- K. Access panels, registers, cabinet heaters, radiators, and electrical panels and similar equipment shall be painted in colors as selected by the Architect.
- L. Exposed piping, conduit, wiremold, ductwork, pipe insulation, and hangers shall be painted in colors selected by the Architect.
- M. Access panel doors and frames shall be painted to match wall color.
- N. Paint equipment, piping, conduit, and exposed duct work in utility areas in colors according to the utilities color coding scheme indicated.
- O. Wall surfaces to receive wall protection panels shall be primed.
- P. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- Q. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- R. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
- S. Sand wood and metal surfaces lightly between coats to achieve required finish.
- T. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- U. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
- V. Paint both sides and edges of plywood backboards for electrical and telephone equipment with fire-resistive paint before installing equipment.

3.05 MARKING OF FIRE AND SMOKE RESISTIVE CONSTRUCTION

- A. Prepare stenciled signs for painted marking of all fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions as identified on the Code Analysis Drawings, above accessible ceilings, in attics and in accessible concealed floor spaces, at intervals not exceeding thirty (30) feet measured horizontally.
 - 1. Lettering shall be 3/4 inches high, of contrasting color to the application surface.
 - 2. Sign text shall be as follows, as applicable:
 - a. FIRE BARRIER - PROTECT ALL OPENINGS
 - b. SMOKE PARTITION - PROTECT ALL OPENINGS

3.06 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.07 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

**SECTION 10 11 01
VISUAL DISPLAY UNITS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Porcelain enamel steel markerboards.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 54 - Wood Blocking and Curbing: Concealed wood blocking.
- B. Section 09 21 16 - Gypsum Board Assemblies: Concealed supports in metal stud walls.
- C. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.03 REFERENCE STANDARDS

- A. ANSI A135.4 - Basic Hardboard; 2012 (Reaffirmed 2020).
- B. ANSI A208.1 - American National Standard for Particleboard; 2022.
- C. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2018.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023c.
- E. PS 1 - Structural Plywood; 2023.
- F. Porcelain Enamel Institute Specifications.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data on markerboard, trim, and accessories. Include surface burning test results. Submit sample warranty.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- D. Manufacturer's printed installation instructions.
- E. Maintenance Data: Include data on regular cleaning and stain removal.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum ten years documented experience.

1.06 WARRANTY

- A. See Section 01 78 10 - Warranties, for additional warranty requirements.
- B. Provide twenty year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.
 - 1. Warranty shall cover replacement cost of the boards.

PART 2 PRODUCTS

2.01 VISUAL DISPLAY BOARDS

- A. Porcelain Enamel Steel Markerboards, Type 71-x:
 - 1. Color: As selected from manufacturer's full range.
 - 2. Steel Face Sheet Thickness: 24 gauge, 0.0239 inch, magnetic facer.
 - 3. Core: Particleboard, 3/8 inch thick, laminated to face sheet.
 - 4. Backing: Aluminum sheet, laminated to core.
 - 5. Size: As indicated on the Drawings. Boards shall be maximum possible lengths to eliminate vertical seams.
 - 6. Heights: As indicated on the Drawings.

7. Lengths: As indicated on the Drawings.
8. Frame: Min 0.062 inch thickness extruded aluminum , with concealed fasteners.
9. Frame Profile: Snap-on trim, manufacturer's standard.
10. Frame Width: 1 inch max.
11. Frame Finish: Anodized, natural.
12. Accessories: Provide marker tray.
13. Manufacturers:
 - a. ASI Visual Display Products.
 - b. Claridge Products and Equipment, Inc.
 - c. Nelson Adams NACO.
 - d. Substitutions: See Section 01 60 00-Product Requirements.

2.02 MATERIALS

- A. Porcelain Enameled Steel Sheet: ASTM A424, Type I, Commercial Steel, with fired-on vitreous finish.
- B. Hardboard for Cores: ANSI A135.4, Class 1 - Tempered, S2S (smooth two sides).
- C. Particleboard: ANSI A208.1; Grade 1-M-1, wood flakes, no urea-formaldehyde added waterproof resin binder, sanded faces.
- D. Aluminum Sheet Backing: 27 gauge, 0.014 inch thick.
- E. Exposed Aluminum Finish: Comply with NAAMM Metal Finish Manual for Architectural and Metal Products.

2.03 ACCESSORIES

- A. Temporary Protective Cover: Sheet polyethylene, 8 mil thick.
- B. Marker Tray: Aluminum, manufacturer's standard profile, one piece full length of markerboard, molded ends, concealed fasteners, same finish as frame.
- C. Mounting Brackets: Concealed.

2.04 FABRICATION

- A. Face and backer sheets of markerboards shall be laminated to the core material under heat and pressure with manufacturer's standard flexible waterproof adhesive.
- B. Coordinate factory assembled units with trim and accessories. Join parts with a neat, precise fit. Make joints only where total length exceeds maximum manufactured length. Fabricate with a minimum number of joints, balanced around the center of the board. Provide manufacturer's standard vertical joint spline system between abutting sections of boards within a unified perimeter frame. Provide manufacturer's standard mullion trim at joints between boards in combination units.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

3.02 PREPARATION

- A. Acclimatize visual display units by removing from packaging in installation area not less than 24 hours before application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Mark locations of all boards on wall surfaces (right and left edges) and review with architect in field prior to installation. Relocate as required per architect direction.

3.03 INSTALLATION

- A. Install boards in accordance with manufacturer's instructions.
- B. See Drawings for mounting height of boards. Any questions or conflicts shall be brought to the attention of the Architect.
- C. Secure units level and plumb.

3.04 CLEANING

- A. Clean board surfaces in accordance with manufacturer's instructions.
- B. Cover with protective cover, taped to frame.
- C. Remove temporary protective cover at Date of Substantial Completion.

END OF SECTION

SECTION 10 14 24
INTERIOR SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. ADA compliant interior signage.
- B. Dimensional letter signage.

1.02 REFERENCES

- A. ANSI/ICC A117.1 - Accessible and Useable Buildings and Facilities; 2018.
- B. ADAAG - Americans with Disabilities Act, Accessibility Guidelines for Buildings and Facilities 2010.
- C. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's descriptive literature.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- D. Shop Drawings: Submit shop drawings showing to scale all sign types including lettering, layout and dimensions.
 - 1. Submit a sign schedule with all signs listed by door number location. Sign schedule shall include sign type, sign text and side of wall for mounting by room number.
 - 2. Submit details, including anchorage to substrate, and electrical connections for exterior signage.
 - 3. Submit elevation drawings of dimensional letter signage, indicating, font type, size, and letter spacing.
- E. Selection Samples: One complete set of color chips representing manufacturer's full range of available colors.
- F. Verification Samples: Two full size samples, representing type, style and color specified including method of attachment.

1.04 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with requirements of ANSI/ICC A117.1 and ADAAG.

1.05 WARRANTY

- A. See Section 01 78 10 - Warranties, for term and other warranty requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Inspect products upon receipt. Store products in manufacturer's packaging until ready for installation.

1.07 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results.

PART 2 PRODUCTS

2.01 INTERIOR ADA-COMPLIANT SIGNS

- A. ADA-Compliant Interior Signage:
 - 1. Type: Three-in-one construction without borders; photopolymer signs with lettering and symbols raised 1/32 inch from sign plate face.
 - 2. Sign Thickness: 1/8 inch thick or 1/4 inch thick as required.

3. Construction: One-piece; added-on or engraved characters not acceptable.
 4. Lettering Style: Helvetica Medium, upper case.
 5. Braille: Grade 2 Braille, placed directly below last line of letters or numbers.
 6. Performance: Non-static, fire-retardant, and self-extinguishing.
 7. Contrast: Letters numbers and symbols shall contrast with background.
 8. Corners: Square.
 9. Color of Plastic: As selected from manufacturer's standard colors.
 10. Finish of Plastic: Matte.
 11. Color of Background: As selected from manufacturer's standard paint colors.
 12. Letter and Number Sizes:
 - a. Room numbers and text, 7/8 inch high.
 - b. Lettering for exit signs, 2 inches high.
 13. Sign Margins: Letters and numbers, 1/2 inch left margin and 3/8 inch top margin.
 14. Sign Sizes:
 - a. Room Number, Restroom, Exit signs, 8 by 8 inches.
 - b. Other Signs: As required, as approved by Architect.
- B. Required Sign Types:
1. Toilet Rooms: All toilet rooms shall be identified by "Restroom" and as scheduled.
 - a. Accessible toilet rooms shall receive a 6" x 6" International Symbol of Access, as specified for door signs..
 - b. Pictograms, if provided shall be located directly above the related text.
 - c. Sprinkler Equipment Rooms, Mechanical, and Electrical Rooms: Room name sign.
- C. Basis of Design Product:
1. Best Signs; Photopolymer signs.
 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DIMENSIONAL LETTER SIGNAGE

- A. Plastic Letters:
1. Material: Injection molded plastic.
 2. Thickness: Manufacturer's standard for letter size.
 3. Letter Height: As indicated on Drawings
 4. Text and Typeface:
 - a. Character Font: As selected by Architect
 - b. Character Case: Upper case only.
 5. Finish: Semi-gloss.
 6. Color: As selected by Architect.
 7. Mounting: Concealed studs.
 8. Product:
 - a. Woodland Manufacturing; Plastic Letters.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine installation areas to ensure that conditions are suitable for installation.
- B. Examine signage for defects prior to installation. Do not install damaged signage.

3.02 PREPARATION

- A. Verify mounting heights and locations for interior signage will comply with referenced standards.
- B. Clean mounting locations of dirt, dust, grease or similar conditions that would prevent proper installation.

3.03 INSTALLATION

- A. Install signs level, plumb, without distortion, and in proper relationship with adjacent surfaces using manufacturer's recommended standard mounting system.
 - 1. Mounting: Mount with tamper-resistant screws, minimum 4 per sign. All signs over ten (10") inches in length shall be furnished with additional intermediate screws (top and bottom). Signs mounted to glass shall be adhered using industrial strength tape.
- B. Mounting Height and Locations:
 - 1. Mounting locations shall be as determined by the Architect.
 - 2. In general, ADA-compliant signs shall be mounted at 60" above the finish floor to the baseline of the highest character. This is a maximum limit and shall not be exceeded.
 - a. For locations where this cannot be done, the Architect shall review and provide location.
 - 3. For door signs, mounting shall be 5" from the door latch jamb; leaving 1" between the edge of frame and edge of sign. Signs shall not be located so as to be obscured by doors in the open position.
 - 4. Signs shall be located so that a person can approach a sign within three (3") inches without encountering obstacles or standing within the swing of the door.
- C. Clean signs and remove adhesive from exposed sign surfaces after installation as recommended by manufacturer.
- D. Replace damaged products before Substantial Completion.

END OF SECTION

SECTION 10 21 23
CUBICLE CURTAINS AND TRACK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface mounted overhead curtain track and guides.
- B. Cubicle curtains.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 54 - Wood Blocking and Curbing: Concealed blocking for rails and tracks.
- B. Section 09 51 00 - Acoustical Ceilings: Suspended ceiling system to support track.
- C. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023b.
- B. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films 2023, with Errata.

1.04 REGULATORY REQUIREMENTS

- A. All products and materials must be approved for sale in and meet local, State, and Federal regulations.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for curtain fabric characteristics.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- D. Shop Drawings: Submit reflected ceiling plan view of curtain track, hangers and suspension points and attachment details. Submit schedule of curtain sizes.
- E. Samples:
 - 1. Submit fabric samples, 12x12 inches minimum in size illustrating fabric color.
- F. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention .
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Carriers: Ten.
 - 3. Extra Curtains: Two.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept curtain materials on site and inspect for damage.
- B. Store curtain materials on site and deliver to Owner for installation when requested.

PART 2 PRODUCTS

2.01 CURTAIN TRACKS AND TRACK COMPONENTS

- A. Track: Extruded aluminum straight and curved sections of lengths to minimize joints; I-beam profile.
 - 1. Profile: Channel.
 - 2. Mounting: Surface.

3. Structural Performance: Capable of supporting vertical test load of 50 lbs without visible deflection of track or damage to supports, safely supporting moving loads, and sufficiently rigid to resist visible deflection and without permanent set.
4. Track Bends: As indicated on the Drawings. Minimum 12 inch radius; fabricated without deformation of track section or impeding movement of carriers.
5. Track End Stop: To fit track section.
6. Finish on Exposed Surfaces: White enamel.
7. Track Size: 3/4" H x 1-3/8" W.
8. Product:
 - a. InPro; Optitrac.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Curtain Carriers: Nylon roller to accurately fit track; designed to eliminate bind when curtain is pulled; fitted to curtain to prevent accidental curtain removal; 2.2 carriers per foot of track length. Ball and chain with metal hooks.
- C. Safety Loading Unit: Provide at each track assembly complete with hinge, latch, 5' of track, wall mount unit. Provide one operating wand.
- D. Installation Accessories: Types required for specified mounting method and substrate conditions.

2.02 CURTAINS

- A. Cubicle Curtains:
 1. ASTM E84: Flame Spread Index of 25, max; Smoke Developed Index of 450, max.
 2. Flammability, NFPA 701: Pass.
 3. Inherently flame resistant or flameproofed; capable of passing NFPA 701 test.
 4. Top of curtain shall be mesh for a minimum of 18 inches for sprinkler head clearances.
 5. Fabric: As selected by Architect from Manufacturers stock options.
 6. Product:
 - a. InPro; EZE-Swap Snap Panel Curtains.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and supports above ceiling are ready to receive work of this Section.
- B. Verify that field measurements are as indicated.

3.02 INSTALLATION

- A. Install curtain track to be secure, rigid, and true to ceiling line.
- B. See Section 06 10 54 for track supports in partitions.
- C. Install curtains on carriers ensuring smooth operation.

END OF SECTION

**SECTION 10 26 01
WALL PROTECTION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Corner guards.
- B. Protective wall covering.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 54 - Wood Blocking and Curbing: Support blocking for wall anchors.
- B. Section 09 21 16 - Gypsum Board Assemblies: Placement of supports in stud wall construction.
- C. Section 09 72 00 - Wall Coverings: Terminating wall covering at wall and door protection.
- D. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.03 REFERENCE STANDARDS

- A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics 2023, with Editorial Revision.
- B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents 2021.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023b.
- D. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2022.
- E. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies 2023.
- F. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).
- G. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.04 REGULATORY REQUIREMENTS

- A. All products and materials must be approved for sale in and meet local, State, and Federal regulations.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- D. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
 - 1. Submit samples of protective wall covering, 6 by 6 inches square.
- E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- F. Maintenance Data: Manufacturer's instructions for care and cleaning of each type of product. Include information about both recommended and potentially detrimental cleaning materials and methods.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.
- B. Protect work from moisture damage.
- C. Protect work from UV light damage.
- D. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

1.07 WARRANTY

- A. See Section 01 78 00 - Project Close-out for additional warranty requirements.

PART 2 PRODUCTS

2.01 PERFORMANCE CRITERIA

- A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.
- B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.
- C. Fungal Resistance: Unless otherwise noted, provide protection products and assemblies which pass ASTM G21 testing.

2.02 PRODUCT TYPES

- A. Wall Protection Panels Types W#A, W#B,: 0.060" thickness, vinyl; manufacturer's accessories.
 - 1. Surface Burning Characteristics, UL 723: Class A, Flame Spread 20 or less; Smoke Developed 400 or less.
 - 2. Seams and Edges: Sealant joint seams.
 - a. Sealant: Manufacturer provided, to be color matched to panels
 - 3. Sheet Size: Maximum sheet size to minimize seams, and as identified on interior elevation Drawings, as applicable.
 - 4. Colors: See Finish Legend. Panels shall be color matched.
 - 5. Adhesive: Water-based, low odor, as recommended by the panel manufacturer.
 - 6. Product:
 - a. Inpro; Palladium Wall Panels.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Corner Guards: Type C#A, C#B, A#B: Surface mounted, high impact uPVC, with aluminum retainer track.
 - 1. Length: One piece, length as shown on Drawings.
 - 2. Wing Size
 - 3. Corner: 90 degree square and 135 degree. Note: All corner angles shall be field verified.
 - 4. Colors: See Finish Legend.
 - 5. Product:
 - a. Inpro; 130 & 160 Series.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Bumper Rail Type B#A: Surface mounted, two types at two levels, non-PVC cover over continuous aluminum retainer and impact bumper; 6-inches high and 4-inches high, manufacturer's accessories.
 - 1. Color: See Finish Legend.
 - 2. Product:
 - a. Inpro; 1400 & 1600 Series.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

- D. Primer: As recommended by wall protection manufacturer, see Section 09 91 23 – Interior Painting.
- E. Adhesive: As recommended by wall protection manufacturer.
- F. Sealant: As recommended by wall protection manufacturer, see Section 07 90 05 – Joint Sealers.

2.03 FABRICATION

- A. Fabricate components with tight joints, corners and seams.

2.04 SOURCE QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Provide wall and door protection systems of each type from a single source and manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.
- B. Verify that field measurements are as indicated on drawings.
- C. Verify that substrate surfaces for adhered items are clean and smooth.
 - 1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer. Follow adhesive manufacturer's recommendations for remedial measures at locations and/or application conditions where adhesion test's results are unsatisfactory.
- D. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.
- B. Wall Protection Panels:
 - 1. Verify wall surfaces are properly primed using a primer compatible with panel adhesive.
 - 2. Clean substrate surfaces to remove dust, debris and loose particles.
 - 3. Locate panel seams per approved shop drawings.
 - 4. Adhere panels to substrate with troweled on adhesive as recommended by the panel manufacturer. Smooth roll the surface.
 - 5. At joints indicated to be caulked, allow for a minimum 1/16 inch wide gap between edges of sheets. Gaps are required to be of consistent width throughout the Project.
 - 6. Install trim pieces, unless other seam and edge finish is specified, as required for a complete installation. Allow tolerance for thermal movement.
 - 7. Use a roller to ensure maximum contact with adhesive.
 - 8. Clean-up surfaces in accordance with manufacturers maintenance instructions.

3.03 TOLERANCES

- A. Maximum Variation From Required Height: 1/8 inch.
- B. Maximum Variation From Level or Plane For Visible Length: 1/8 inch.

3.04 CLEANING

- A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

SECTION 10 28 00
TOILET AND HEALTHCARE ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Accessories for toilet rooms, bathrooms, utility rooms and other fixtures at locations indicated on the Drawings.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 54 - Wood Blocking and Curbing: Concealed wood blocking.
- B. Section 09 21 16 - Gypsum Board Assemblies: Metal stud partitions for special loading imposed by grab bars and diaper changing stations.
- C. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.03 REFERENCE STANDARDS

- A. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- C. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement and blocking to receive anchor attachments.

1.05 REGULATORY REQUIREMENTS

- A. All products and materials must be approved for sale in and meet local, State, and Federal regulations.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods. Indicate special procedures and conditions requiring special attention.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- D. Close-out Requirements: Submit maintenance data, operating instructions and keys required for each type of equipment and lock.

1.07 PRODUCT HANDLING

- A. Deliver items in manufacturer's original unopened protective packaging. Store materials as required to prevent soiling, damage, or wetting. Maintain protective covers on all units. Remove protective covers at final clean-up of installation.

1.08 WARRANTY

- A. Provide manufacturer's standard product warranty for mirrors against silver spoilage for ten (10) years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Bobrick Washroom Equipment, Inc.

- B. Acceptable Substitute Manufacturers:
 - 1. Bradley Corp.
 - 2. American Specialties, Inc.
 - 3. Substitutions: Section 01 60 00 - Product Requirements.
- C. All items of each type to be made by the same manufacturer.

2.02 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
 - 1. Grind welded joints smooth.
 - 2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.
- B. Stainless Steel Sheet: ASTM A666, Type 304, 0.034 inch (22 gage) minimum thickness, unless otherwise indicated.
- C. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653, with G90/Z275 coating.
- D. Adhesive: Two component epoxy type, waterproof.
- E. Fasteners, Screws, and Bolts: Hot dip galvanized, tamper-proof and of same materials as accessory where exposed.

2.03 FINISHES

- A. Stainless Steel: No. 4 Brushed finish.
- B. Chrome/Nickel Plating: ASTM B456, SC 2, satin finish.

2.04 TOILET ROOM ACCESSORIES

- A. NOTE: Accessory item numbers correspond to accessory symbol numbers on the Drawings.
- B. Item 1B - Toilet Paper Dispenser: Surface mounted.
 - 1. Furnished by Owner, installed by Contractor.
- C. Item 2C - Paper Towel Dispenser: Surface mounted.
 - 1. Furnished by Owner, installed by Contractor.
- D. Item 6B Napkin Disposal Receptacle: Recessed, Stainless steel, welded.
 - 1. Products: B-353 by Bobrick.
- E. Item 7A - Mirror: Stainless steel welded framed, 6 mm thick tempered glass mirror; non-absorptive backing filler and galvanized sheet steel backer plate; surface mounted. Dimensions as indicated on Drawings
 - 1. Products: B-2908 Series by Bobrick.
- F. Item 8A Shelf: Surface mounted, Stainless steel, welded. 16 inch length
 - 1. Products: B-295x16 by Bobrick.
- G. Item 10C - Soap Dispenser: Surface-mounted.
 - 1. Furnished by Owner, installed by Contractor.
- H. Item 11A - Robe Hook: Heavy-duty stainless steel, single-prong, square-shaped bracket and backplate for concealed attachment, satin finish.
 - 1. Products: B-6717 by Bobrick.
- I. Item 13B – Grab Bars: Stainless steel, 1-1/4 inches outside diameter, minimum 0.05 inch wall thickness, satin with non-slip grasping surface finish, concealed flange mounting; 1-1/2 inches clearance between wall and inside of grab bar. Lengths: 18, 42, 36 inches and as indicated on the Drawings or as required by ANSI A117.1
 - 1. Products: 36" Length – 8320-106360 by Bobrick, 42" Length – 8320-106420 by Bobrick.
- J. Item 100 - Sharps Container: Surface mounted.

- 1. Product: Furnished by Owner and installed by Owner.
- K. Item 102A - Glove Dispenser: Surface mounted.
 - 1. Product: Furnished by Owner and installed by Contractor.
- L. Item 105 – Hand Sanitizer: Surface mounted.
 - 1. Product: Furnished by Owner and installed by Contractor.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work. Check opening scheduled to receive recessed units for correct dimensions, plumbness of blocking or frames, and preparation that would affect installation of accessories.
- B. Verify exact location of accessories for installation. Check for conditions that would affect placement, quality and execution of work.
- C. Verify that field measurements are as indicated on drawings. Verify spacing of plumbing fixtures and toilet partitions that affect installation of accessories.
- D. See Section 06 10 54 - Wood Blocking and Curbing, for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings. Do not begin installation of accessories until openings and surfaces are acceptable and adequate blocking has been provided

3.02 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on the drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
- D. Mounting Heights and Locations: As required by accessibility regulations and as indicated on drawings.
- E. Secure all items to concealed blocking or anchor plates installed in walls. All anchors shall be fully concealed.
 - 1. Stationary grab bar mounting devices and supports within walls shall support a concentrated force of 250 pounds applied at any point in any direction 4" from the face of the wall.
 - 2. Diaper changing cabinet mounting devices and supports within walls shall support a concentrated force of 200 pounds applied at any point in any direction 11" from the face of the wall.
- F. All accessories installed in wet shower areas shall have fastener penetrations sealed with silicone sealant.
- G. Adjust accessories for proper operation. After completion of installation, clean and polish all exposed surfaces. Deliver keys and instruction sheet to Owner. All keys shall be clearly labeled.
- H. Paper towel and soap dispensers shall be installed at all sinks outside of restrooms, whether indicated or not on the Drawings.

END OF SECTION

SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers and fire extinguisher cabinets, and accessories.
- B. See Code Analysis Key Plan and Floor Plan Drawings for locations.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 54 - Wood Blocking and Curbing: Wood blocking and shims.
- B. Section 09 21 16 - Gypsum Board Assemblies: Roughed-in metal stud wall openings.
- C. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.03 REFERENCE STANDARDS

- A. NFPA 10 - Standard for Portable Fire Extinguishers; 2022.
- B. UL - Fire Protection Equipment Directory; current edition.

1.04 REGULATORY REQUIREMENTS

- A. All products and materials must be approved for sale in and meet local, State, and Federal regulations.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit fire extinguisher and cabinets, operational features, color, finish, and anchorage details.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- D. Shop Drawings: Indicate cabinet physical dimensions and rough-in measurements for recessed cabinets. Verify that cabinets are sized to accommodate the type and capacity of extinguishers specified.
- E. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.06 FIELD CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent. Provide extinguishers labeled by UL for the purpose specified and indicated.
- B. Fire Extinguisher Manufacturers:
 - 1. Basis of Design: J.L. Industries.
 - 2. Acceptable Substitute Manufacturers:
 - a. Larsen's Manufacturing Co.
 - b. Potter-Roemer.
 - c. Amerex Corp.
 - d. Substitutions: See Section 01 60 00-Product Requirements.
- C. Dry Chemical Type Fire Extinguishers: Extinguisher unit containing a fluidized and siliconized mono ammonium phosphate powder; nonconductive and nontoxic.
 - 1. Location: Typical, unless otherwise noted.

2. Construction: Heavy duty steel cylinder with metal valve and siphon tube, O-ring seal, replaceable valve stem seal, visual pressure gage, pull pin and upright squeeze grip.
3. Class: 4A:80B:C.
4. Size: 10 pound.

2.02 FIRE EXTINGUISHER CABINETS

- A. Basis of Design Manufacturer: J.L. Industries.
- B. Acceptable Substitute Manufacturers:
 1. Larsen's Manufacturing Co
 2. Potter-Roemer.
 3. Nystrom, Inc.
 4. Substitutions: See Section 01 60 00-Product Requirements.
- C. Semi-Recessed Fire Extinguisher Cabinet, Type 62:
 1. Components:
 - a. Tub: Cold-rolled steel.
 - 1) Finish: Factory-applied powder coat paint finish.
 - (a) Standard color: White.
 - 2) Interior Dimension: 10-1/2 inch by 24 inch by 6 inch.
 - b. Door and Trim Construction: Flush doors with 5/8 inch (15.88 mm) doorstop attached by continuous hinge and equipped with zinc-plated handle with roller catch.
 - 1) Finish: Factory-applied powder coat paint finish.
 - (a) Standard color: White.
 - c. Door Style:
 - 1) Style F: Full glazing with pull handle.
 - d. Glazing: Acrylic.
 - 1) Standard Color: Clear.
 - e. Trim Style and Depth:
 - 1) Semi-Recessed Cabinet:
 - (a) Trim Projection: 3 inch rolled.
 - f. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
 - g. Fabrication: Weld, fill, and grind components smooth.
 - h. Fire Rating: Provide fire rated type where located in fire rated wall.
 - i. Signage: Provide tent type signage above.
 2. Product: JL Industries; Ambassador Series #C1017 with FX2 option in fire rated walls.
 - a. Substitutions: See Section 01 60 00 - Product Requirements.
 - a. .

2.03 ACCESSORIES

- A. Type 64 - Extinguisher Brackets: Formed steel, chrome-plated. Provide wall brackets for all extinguishers not indicated to be in a cabinet. Brackets shall be as recommended by the fire extinguisher manufacturer for weight and size of the extinguisher to be hung. Finish shall match the extinguishers. Provide spring-type metal straps to secure the extinguisher on hook.
 1. Applications: Mechanical rooms and elevator machine rooms.
- B. Cabinet Signage: Plastic, 3-D tent type.
 1. Provide above all fire extinguisher locations, bottom of sign 6'-8" a.f.f.
 2. Basis of Design: 24S by JL Industries Inc.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Verify as-built conditions before starting work. Verify rough openings for cabinet are correctly sized and located.

- B. See Code Analysis Key Plan Drawings for fire extinguisher locations. Refer to the Drawings for locations of fire extinguisher cabinets and fire extinguishers (designated F.E.C.), wall mounted fire extinguishers without cabinets (designated F.E.). Locations shown on the Drawings are approximate. Verify all locations and mounting heights with the Architect prior to roughing-in of cabinets or mounting brackets. In general, fire extinguishers shall be installed no higher than 4'-0" AFF to top of unit.
- C. Install in accordance with manufacturer's instructions. Install cabinets plumb and level in wall openings, no higher than 4'-0" inches from finished floor to top of cabinet. Secure rigidly in place.
- D. Place extinguishers in cabinets and on wall brackets as indicated. All fire extinguishers shall be fully charged and inspected within one (1) month prior to date of Substantial Completion.
- E. Position cabinet signage at each extinguisher location. Verify placement in field with architect.

END OF SECTION

SECTION 11 31 00
APPLIANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Installation of Owner furnished appliances.

1.02 RELATED REQUIREMENTS

- A. Section 06 41 00 - Architectural Wood Casework.

1.03 QUALITY ASSURANCE

- A. Installer Qualifications: Experienced appliance installer of appliances required for this Project.

PART 2 PRODUCTS

2.01 APPLIANCES

- A. Appliances Furnished by Owner: Appliances shall include but not be limited to: Refrigerators, icemakers and microwaves.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify utility rough-ins are provided and correctly located.
- B. Examine cabinet installation with the appliance installer to verify proper conditions. Proceed with the installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Anchor built-in equipment in place to supporting cabinets or countertops with concealed fasteners.
- C. Verify that clearances are adequate for proper functioning and rough openings are completely concealed. Place freestanding equipment in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- D. Provide all miscellaneous installation kits required for complete and proper installations for all appliances.

3.03 CLEANING

- A. Remove packing materials from equipment and properly discard.
- B. Clean equipment, leave in a condition ready for operation.

END OF SECTION

**SECTION 12 24 00
WINDOW SHADES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior manual roller shades.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 54 - Wood Blocking and Curbing: Concealed wood blocking for attachment of headrail brackets.
- B. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.03 REFERENCE STANDARDS

- A. NFPA 701 – Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2023, with Errata.
- B. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems Current Edition, Including All Revisions.
- C. WCMA A100.1 - Standard for Safety of Window Covering Products 2022.

1.04 REGULATORY REQUIREMENTS

- A. All products and materials must be approved for sale in and meet local, State, and Federal regulations.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to provide rough-in of electrical wiring as required for installation of hardwired motorized shades.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- D. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.
- E. Source Quality Control Submittals: Provide test reports indicating compliance with specified fabric properties.
- F. Verification Samples: Minimum size 6 inches square, representing actual materials, color and pattern.
- G. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- H. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.
- I. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

- B. Installer Qualifications: Company specializing in performing work of this type with minimum five years of documented experience with shading systems of similar size and type, being manufacturer's authorized rep with factory training.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.
- B. Handle and store shades in accordance with manufacturer's recommendations.

1.09 FIELD CONDITIONS

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.10 WARRANTY

- A. Provide manufacturer's standard 5 year warranty from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS:

- A. Roller Shades:
 - 1. Basis of Design: Draper.
 - 2. Acceptable Alternate Manufacturers:
 - a. MechoShade Systems LLC
 - b. Hunter Douglas.
 - c. SWF Contract
 - d. Substitutions: See Section 01 60 00-Product Requirements.

2.02 ROLLER SHADES

- A. General:
 - 1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
 - 2. Provide shade system that operates smoothly when shades are raised or lowered.
- B. Roller Shades, Type WT-1 & WT-2:
 - 1. Basis of Design: Draper, Clutch Operated Flex Shade.
 - 2. Description: Single roller, manually operated fabric window shades.
 - a. Drop Position: Regular roll.
 - b. Mounting: Window jamb mounted.
 - c. Size: To fit window opens as indicated on drawings.
 - d. Fabric: As indicated on Finish Legend.
 - 3. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
 - a. Material: Steel, 1/8 inch thick.
 - 4. Roller Tubes:
 - a. Material: Extruded aluminum.
 - b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
 - c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
 - d. Capable of being removed and reinstalled without affecting roller shade limit adjustments.
 - 5. Hembars: Designed to maintain bottom of shade straight and flat.
 - a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
 - 6. Clutch Operator: Manufacturer's standard material and design integrated with bracket/brake assembly.

- a. Provide a permanently lubricated brake assembly mounted on an oil-impregnated hub with wrapped spring clutch.
 - b. Brake must withstand minimum pull force of 50 lb in the stopped position.
 - c. Mount clutch/brake assembly on the support brackets, fully independent of the roller tube components.
7. Drive Chain: Continuous loop stainless steel beaded ball chain, 95 lb minimum breaking strength. Provide upper and lower limit stops.
 - a. Chain Retainer: Chain tensioning device complying with WCMA A100.1.
8. Accessories:
 - a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; baked enamel finish.
 - 1) Color: As selected by architect from manufacturer standard options.
 - 2) Profile: Square.
 - b. Fasteners: Noncorrosive, and as recommended by shade manufacturer.
9. Shade Fabric:
 - a. Flame-resistant, fade resistant, meeting NFPA 701.
 - 1) Product: As indicated on Finish Legend
 - 2) Colors: As selected by the Architect from the manufacturer's standard full range.
10. Roller Shade Fabrication
 - a. Field measure finished openings prior to ordering or fabrication.
 - b. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
 - 1) Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window stool.
 - 2) Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine finished openings for deficiencies that may preclude satisfactory installation.
- B. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

- A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
- B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
- B. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 CLEANING

- A. Clean soiled shades and exposed components as recommended by manufacturer.
- B. Replace shades that cannot be cleaned to "like new" condition.

3.05 PROTECTION

- A. Protect installed products from subsequent construction operations.
- B. Touch-up, repair, or replace damaged products before Substantial Completion.

3.06 MAINTENANCE

- A. See Section 01 78 00 - Project Closeout, for additional requirements relating to maintenance service.

END OF SECTION

**SECTION 12 36 00
COUNTERTOPS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Epoxy resin countertops.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 54 - Wood Blocking and Curbing: Concealed wood blocking.
- B. Section 06 41 00 - Architectural Wood Casework.
- C. Division 22 - Plumbing: Sinks.
- D. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.03 REFERENCE STANDARDS

- A. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
- E. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2024.
- F. PS 1 - Structural Plywood; 2023.

1.04 REGULATORY REQUIREMENTS

- A. All products and materials must be approved for sale in and meet local, State, and Federal regulations.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets for surfacing, substrate and other products; include manufacturer's maintenance instructions and recommendations.
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- D. Shop Drawings: Complete details of materials and installation, combine with shop drawings of cabinets and casework specified in other sections.
- E. Verification Samples: Submit 4 inches square minimum size samples representing actual products and colors selected.
- F. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
- G. Installation Instructions: Manufacturer's installation instructions and recommendations.
- H. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Same fabricator as for Section 06 41 00 - Architectural Wood Casework.

- B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than five years of documented experience.
- C. Quality Certification:
 - 1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
 - 2. Provide designated labels on shop drawings as required by certification program.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.08 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOP ASSEMBLIES

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.
- B. Epoxy Resin Countertops: Filled epoxy resin molded into homogenous, non-porous sheets; no surface coating and color and pattern consistent throughout thickness; with integral or adhesively seamed components.
 - 1. Manufacturers:
 - a. Durcon, Inc.
 - b. Prime Industries, Inc.
 - c. Substitutions: See Section 01 60 00-Product Requirements.
 - 2. Flat Surface Thickness: 1 inch, nominal.
 - 3. Back and Side Splash Thickness: 1/2 inch, nominal.
 - 4. Chemical-Resistance: Provide products that resist the following chemicals with not more than Moderate Effect when tested in accordance with NEMA LD 3:
 - 5. Flammability: Self-extinguishing, when tested in accordance with ASTM D635.
 - 6. NSF approved for food contact.
 - 7. Surface Finish: Smooth, non-glare.
 - 8. Color: Black.
 - 9. Exposed Edge Shape: 3/16 inch radius corner.
 - 10. Drip Edge: Drip groove 1/8 inch wide and deep, located 1/2 inch back from edge on underside of all exposed edges.
 - 11. Back and End Splashes: Same material, same thickness; separate for field attachment

2.02 MATERIALS

- A. Plywood for Supporting Substrate, where indicated: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
- B. Joint Sealant: Mildew-resistant silicone sealant, clear. See Section 07 90 05.
- C. Grommets: Plastic, 3" outside diameter; colors selected from manufacturer's full color range.
 - 1. Product: TG Flip-Top Series; Doug Mockett Co., Inc.

2.03 FABRICATION

- A. Fabricate in accordance with standards governing fabrication quality that are specified in herein. Field conditions shall be carefully measured prior to fabrication of countertops.
- B. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.

1. Join lengths of tops using self-leveling metal splines to draw sections together.
 2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
 - a. Rout a 1/8 inch drip groove at underside of exposed overlapping edges, set back 1/2 inch from face of edge.
 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- C. Provide back and end splashes wherever counter edge abuts vertical surface unless otherwise indicated. Fabricate splashes 4 inches high, unless otherwise indicated. Splashes shall be fabricated loose, unless indicated to be integral with the counter surface.
1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
 2. Height: 4 inches, unless otherwise indicated.
- D. Epoxy Resin Countertops:
1. Fabricate tops up to 144 inches long in one piece.
 2. Join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.
 3. Provide loose back and side splashes.
 4. Located seams at least 3 inches from corners.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.
- C. Acclimate countertop materials to temperature and relative humidity of the installation site for at least 24 hours.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Acclimate countertop materials to temperature and relative humidity of the installation site for at least 24 hours.

3.03 INSTALLATION

- A. Install laboratory worksurface countertops in compliance with requirements of SEFA 2.
- B. Securely attach countertops to cabinets using concealed fasteners and with contact surfaces set in waterproof glue. Verify that cabinet top surfaces are level. Shim where required.
- C. Counter cleats shall be installed at walls where indicated and where required for counter support. At countertops with no sinks, if counter cantilevers more than 3 inches beyond cabinet support, install 3/4" plywood over cabinet tops extending to full countertop cantilever. Use moisture resistant MDF at counters with sinks.
- D. Epoxy REsin Countertops:
 1. Secure countertops to cabinets with manufacture approved adhesives.
 2. Provide for expansion per manufacturer instructions.
 3. Sealant joints shall be 1/8 inch minimum in width.
 4. Seam and finish joints as recommended by the manufacturer.
- E. Loose countertop side splashes shall be set in a continuous bead of silicone sealant at the countertop and at the wall.

1. Provide a neat continuous bead of silicone at the joint between top of splash and vertical wall surface.

3.04 TOLERANCES

- A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
- B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
- C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

- A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

- A. Protect installed products until completion of project.
- B. Any scratched or defaced materials shall be completely replaced at no additional cost to the Owner.
- C. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 21 10 00

FIRE-SUPPRESSION SPRINKLER SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
 - 1. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. The fire protection system shall be an automatic sprinkler system arranged to properly protect the building and shall meet NFPA 13, local, and State requirements.
- B. Provide dry pipe sprinkler system for any and all exterior (outside the building) piping for full coverage.
- C. This Section includes fire-suppression sprinklers, piping, and equipment.
- D. The Sprinkler Contractor shall place the sprinkler system in service and hand over the sprinkler system to the General Contractor for care and maintenance.
- E. Performance and Design Criteria: Provide products and systems complying with specific performance and design criteria indicated.
 - 1. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.

1.03 SYSTEM PERFORMANCE REQUIREMENTS

- A. Design sprinklers and obtain approval from authorities having jurisdiction. The design of the automatic sprinkler system shall be complete with all necessary accessories for proper operation.
- B. The system shall be hydraulically calculated in accordance with all provisions of the Contract Documents and any authority having jurisdiction.
- C. The contract documents do not include a fire pump. Provide over-sized piping as required to meet required system hydraulics. Contractor shall review the civil plans, the existing site and existing fire flow data. If the contractor or authority with jurisdiction determines that a fire pump is required: Provide in accordance with NFPA 20, "Stationary Pumps for Fire Protection," for fire pumps, drivers, controllers, accessories, and their installation.
- D. Design sprinkler piping according to the following and obtain approval from authorities having jurisdiction:

1. Include a 5 percent margin of safety for available water flow and pressure.
 2. Include losses through water-service piping, valves, and backflow preventers.
- E. Sprinkler Occupancy Hazard Classifications:
1. Light Hazard:
 - a. Office and Public Areas
 - b. Corridors
 - c. Libraries except Stack Areas: Light Hazard.
 - d. Classrooms - educational
 2. Ordinary Hazard, Group 1:
 - a. General Storage Areas
 - b. Mechanical Equipment Rooms
 - c. Building Service Areas.
 - d. Electrical Equipment Rooms
 - e. Art Rooms
 - f. Maker Spaces
 3. Ordinary Hazard, Group 2
 - a. Library Stack Areas
 - b. Industrial Arts Shops
 - c. Printing and publishing
- F. Minimum Density for Automatic-Sprinkler Piping Design shall be in accordance with NFPA 13. Maximum Protection Area per Sprinkler shall be in accordance with NFPA 13.

1.04 GENERAL REQUIREMENTS

- A. Components and Installation: Capable of producing piping systems with 175-psig minimum working-pressure rating, unless otherwise indicated.
- B. Protect all systems from freezing. Provide freeze protection for sprinklers in unheated areas with a dry pipe system.
- C. Bundled/Grouped wired in concealed spaces: Non-combustible spaces having 15 or more non-plenum-rated wires grouped together shall be fully sprinklered.
- D. Seismic Performance: If required by the authority with jurisdiction, fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to NFPA 13.
- E. Elevators: Provide sprinkler protection in accordance with authority with jurisdiction requirements.
- F. Coordinate fire department connection type and location with local fire department.
- G. The sprinkler contract starts inside the sprinkler valve room with a connection to the water entry. Coordinate with the site contractor.

- H. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire stop materials. Refer to Division 7 for materials. Seal all penetrations through fire-or smoke-rated wall, partition, ceiling, or roof assemblies with firestopping system. Refer to Architectural plans for location of rated assemblies.
- I. Contractor shall obtain and pay for required permits.

1.05 SUBMITTALS

- A. Shop Drawings: Submit working plans, prepared according to NFPA 13, and hydraulic calculations with cross reference to applicable drawings, water supply data, and equipment schedule with ratings for the system to the Owner's Representative, Insurance Underwriter, and other authorities having jurisdiction.
- B. Product Data: Catalog sheets, specifications, and installation instructions. Indicate UL or FM approval for each product. Include the following additional information:
 - 1. Pipe and fitting materials and methods of joining for sprinkler piping.
 - 2. Pipe hangers and supports.
 - 3. Piping seismic restraints.
 - 4. Valves, including specialty valves, accessories, and devices.
 - 5. Alarm devices. Include electrical data.
 - 6. Electrical Devices: Complete description of intended use, wiring diagrams, data plate information and, in the case of switching devices, whether normally on or normally off. Include motor test data.
 - 7. Mechanical Devices: Complete description of intended use, including normal operating capacities and working pressures.
 - 8. Enclosures: Dimensions, materials, gages of metals; type of door hinges and locks, and methods of securing the enclosure members to the building construction.
 - 9. Hose Threads: Verify that hose threads on fire department connections match threads on equipment used by the local or servicing fire department.
- C. Design Data: The portions of the sprinkler system not sized on the Contract Drawings shall be sized in accordance with NFPA requirements for Hydraulically Designed Systems. Submit drawings and hydraulic calculations for approval.
- D. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three copies of a statement, signed and sealed by the responsible sprinkler system design professional. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Certification: Submit Contractor's NICET certification and number or PE license number.
- E. Field Test Reports and Certificates: 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."
- F. Maintenance Data: For each type of sprinkler specialty to include in maintenance manuals specified in Division 1.

1.06 QUALITY ASSURANCE

A. Sprinkler Contractor

1. **Installer Qualifications:** An experienced installer who has designed and installed fire-suppression piping similar to that indicated for this Project and obtained design approval and inspection approval from authorities having jurisdiction.
2. **Engineering Responsibility:** Preparation of working plans, calculations, and field test reports by a qualified sprinkler designer. Sprinkler designer shall be legally qualified and licensed to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of fire-suppression piping that are similar to those indicated for this Project in material, design, and extent.
 - a. Base calculations on results of a fire hydrant flow test, in accordance with NFPA 13 and NFPA 291. Regardless of the flow/pressure data presented in these documents acquired during the design process, NFPA 13 requires the flow test to be performed no more than 12 months prior to the working plan submittal. If an updated flow test is required for the calculations, the Sprinkler Contractor is responsible for such test.
3. Contractor shall be a licensed fire sprinkler contractor.

B. Manufacturer Qualifications:

1. Firms whose equipment, specialties, and accessories are listed by product name and manufacturer in UL's "Fire Protection Equipment Directory" and FM's "Fire Protection Approval Guide" and that comply with other requirements indicated.
2. **Sprinkler Components:** Listing/approval stamp, label, or other marking by a testing agency acceptable to authorities having jurisdiction.
3. **Electrical Components, Devices, and Accessories:** Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
4. Factory Mutual Engineering Corporation (FM) Approval Guide

C. NFPA Requirements: Year edition per authority of jurisdiction.

1. NFPA #1: Fire Prevention Code
2. NFPA #13: Standard for the Installation of Sprinkler Systems
3. NFPA #14: Standard for the Installation of Standpipe, Private Hydrants and Hose Systems
4. NFPA #20: If a fire pump is required, comply with NFPA 20: Stationary Pumps for Fire Protection.
5. NFPA #24: Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
6. NFPA #101: Life Safety Code
7. NFPA #291: Recommend Practice for Flow Testing and Marking of Hydrants.

1.07 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

- C. Coordinate requirements for access panels and doors for fire-suppression items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8.
- D. Coordinate sprinkler head layout with all other trades.

1.08 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Sprinkler Cabinets: Finished, wall-mounting steel cabinet and hinged cover, with space for a minimum of six spare sprinklers plus sprinkler wrench. Include the number of sprinklers required by NFPA 13 and wrench for sprinklers. Include separate cabinet with sprinklers and wrench for each type of sprinkler on Project.

PART 2 - PRODUCTS

2.01 PIPING

- A. Pipe and fittings shall conform to the requirements of NFPA 13. Pipe shall be listed by UL and be FM approved, and installed per its listing and approval.
- B. Wet sprinkler piping shall be:
 - 1. Black steel Schedule 40 for 1 inch and smaller, and Schedule 10 for 1-½ inch and larger.
- C. Dry sprinkler piping shall be black steel Schedule 40.
- D. System piping shall be substantially supported to the building structure. The installation of hangers and supports shall adhere to the requirements set forth in N.F.P.A. 13. Materials used in the installation or construction of hangers and supports shall be listed and approved for such application.
- E. Provide joining materials in accordance with NFPA 13.
- F. Transition Couplings: AWWA C219, sleeve type, or other manufactured fitting the same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

2.02 SPRINKLERS

- A. Fire sprinklers shall be of one manufacturer throughout the building. No mixing of sprinkler brands shall be permitted. Sprinklers shall be of all brass frame construction with a quick response frangible bulb type fusible element.
- B. Automatic Sprinklers: With U.L. listed heat-responsive elements.
- C. Sprinkler Types and Categories: Provide per NFPA 13.
- D. Provide quick response sprinklers.
- E. Sprinkler Escutcheons: Materials, types, and finishes of sprinklers. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

- F. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

2.03 SPRINKLER SPECIALTY FITTINGS

- A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig minimum working-pressure rating, and made of materials compatible with piping.
- B. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body; with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.
- C. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.
- D. Sprinkler Inspector's Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.
- E. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.
- F. Dry-Pipe-System Fittings: UL listed for dry-pipe service.
- G. Contractor Option: Provide flexible sprinkler hose with fittings intended for use in sprinkler systems between the branch line and sprinkler. Provide in accordance with NFPA 13 and the manufacturer's installation instructions. Length: 38".
 - 1. U.L. 2443 listed for sprinkler hose application.
 - 2. Flexible Hose: Corrugated Stainless Steel AISI 304
 - 3. Slip Nuts: Brass C3771BC
 - 4. Reducer Fitting: Yellow Zinc/Steel SPPS
 - 5. Special Shoulder Nipple (Inlet): Yellow Zinc/Steel SPPS
 - 6. Reducing Nipple Clamp & Bolt: Galvanized Steel SS41
 - 7. Maximum Working Pressure of Flexible Connection: 200 PSI
 - 8. Test Pressure of Flexible Connection: 400 PSI
 - 9. Maximum Temperature Rating of Flexible Connection: 300 °F
 - 10. Provide ceiling bracket.

2.04 VALVES

- A. Valves shall be UL listed and FMG approved
- B. An NFPA-13 compliant setup including a backflow device, system control valve, flow switch, inspectors test, drain, and pressure gauge may be provided in lieu of an alarm valve.
- C. System Control Valve: The wet system control valve shall be a listed indicating type valve. Control valve shall be UL Listed and Factory Mutual Approved for fire protection installations. System control valve shall be rated for normal system pressure but in no case less than 175 PSI.
- D. Manual or automatic air venting valve to exhaust trapped air in the wet sprinkler system.
- E. Dry-Pipe Valves:
 - 1. Standard: UL 260.
 - 2. Design: Differential-pressure type.

3. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gauges, priming chamber attachment, and fill-line attachment.
 4. Air-Pressure Maintenance Device:
 - a. Standard: UL 260.
 - b. Type: Automatic device to maintain minimum air pressure in piping.
 - c. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig adjustable range, and 175-psig outlet pressure.
 5. Air Compressor:
 - a. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
 - b. Motor Horsepower: Fractional.
 - c. Sized for application and capable of achieving system supervisory pressure within 30 minutes in accordance with requirements of NFPA 13. Provide ASME air receiver tank as required to meet requirements on larger systems.
 - d. Include filters, relief valves, coolers, automatic drains, and gauges.
- F. Automatic (Ball Drip) Drain Valves:
1. Standard: UL 1726.
 2. Pressure Rating: 175-psig minimum.
 3. Type: Automatic draining, ball check.
 4. Size: NPS 3/4.
 5. End Connections: Threaded.

2.05 WATERFLOW ALARMS

- A. Flow of water equal to or greater than that from a single automatic sprinkler (smallest orifice in system) shall result in an audible alarm on the premises within 5 minutes after such flow begins and until such flow stops.
- B. The alarm apparatus shall consist of a listed alarm check valve or other listed waterflow-indicating device with the necessary attachments to give an alarm.
- C. The apparatus for a dry pipe system shall consist of alarm attachments to the dry pipe valve.

2.06 FIRE DEPARTMENT CONNECTION

- A. A system fire department connection shall be provided on the system riser in accordance with NFPA 13. Fire department connection shall be UL Listed and Factory Mutual Approved for fire protection use.
- B. Cast brass body, brass clapper inlets, brass plate, adapters and plugs with chain.

- C. Include inlets with threads according to NFPA 1963 and local fire department requirements.
- D. Provide escutcheon plate and labeling per NFPA 13.

2.07 BACKFLOW PREVENTION

- A. Provide in accordance with manufacturers recommendations.
- B. Provide in accordance with NFPA 13. Provide a permanent means of testing the backflow preventer in accordance with NFPA 13 requirements.
- C. Backflow preventer types; provide as required by the local water district.
 - 1. Double check: Watts Series 709DCDA or 774DCDA detector check fire service applications; or approved equal.
 - 2. RPZ: Watts Series 909RPDA or 994RPDA, detector check fire service applications; or approved equal. Provide proper drainage.

PART 3 - EXECUTION

3.01 EARTHWORK

- A. Refer to Division 31 for excavating, trenching, and backfilling.

3.02 EXISTING SYSTEMS

- A. Refer to Division 1 demolition requirements and procedures. Disconnect, demolish, and remove fire-suppression systems, equipment, and components indicated to be removed.
- B. Existing Sprinkler System Shutdown: Follow NFPA 13 and NFPA 25 recommendations. Before shutting down the sprinkler system to perform the Work, notify the Owner's Representative in writing, the local fire department, and the alarm company, that the system is to be shut down temporarily. Give schedule which states date and time of proposed shut down and the approximate length of time that the system will be out of service. Request instructions for precautions that should be taken during the shutdown period. Do not shut down the system until schedule is approved by the Owner's Representative. Return the existing system to pre-shutdown operation immediately after the Work has been completed. Give written notice to the Director's Representative that the system has been returned to pre-shutdown operation.

3.03 SERVICE-ENTRANCE PIPING

- A. Extend fire-suppression water-service piping and connect to water-supply source and building fire-suppression water-service piping systems at locations and pipe sizes indicated. Coordinate with site contractor, Division 21 work starts 5 feet outside the building wall.
- B. Terminate fire-suppression water-service piping within the building at the floor slab until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material.

- C. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.
- D. Refer to Division 31 for exterior piping.
- E. Comply with NFPA 24 for fire-service-main piping materials and installation.
- F. Provide ductile-iron, water-service piping according to AWWA C600 and AWWA M41. Provide underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports. Install sleeve seals for piping penetrations of concrete walls and slabs.
- G. Provide shutoff valve, pressure gage, drain, and other NFPA-required accessories at connection to water-service piping.
- H. Provide backflow prevention as required by the local water district.

3.04 PREPARATION

- A. The nature of the work requires coordination with other trades. Shop fabrication shall be done at the Contractor's risk. Relocation of piping and components to avoid obstructions may be necessary. Relocation, if required, shall be done at the Contractor's expense. The installation shall be performed in a workmanlike manner as determined by the Owner's Representative and in accordance with the Contract Documents, manufacturer's printed installation instructions, and submitted and Owner's Representative reviewed drawings.

3.05 SPRINKLER APPLICATIONS

- A. General: Use sprinklers according to the following applications:
 - 1. Rooms/spaces without Ceilings: Upright sprinklers.
 - 2. All occupied rooms with Finished Ceilings: Recessed Pendent.
 - 3. Provide sprinkler guards for heads in mechanical and storage spaces, less than 8 ft. above finished floor subject to mechanical damage.
 - 4. Low ceilings (under 8 feet): Concealed
 - 5. Electrical or Data Rooms with finished ceilings: Concealed
 - 6. Electrical or Data Rooms without ceilings: Provide guard
 - 7. Attics: attic sprinklers.
 - 8. Wall Mounting: Sidewall sprinklers.
 - 9. Spaces Subject to Freezing: Upright; pendent, dry-type; and sidewall, dry-type sprinklers.
 - 10. Special Applications: Use extended-coverage, flow-control, and quick-response sprinklers where indicated.
- B. Finishes
 - a. Unfinished spaces not exposed to view: rough bronze.
 - b. Recessed Sprinklers: White
 - c. Provide escutcheons with matching color for finished spaces.

- d. Exposed sprinklers subject to corrosive atmospheres shall have a factory applied corrosion resistant coating.

3.06 SYSTEM INSTALLATIONS

- A. Earthquake Protection: Provide piping according to NFPA 13 to protect from earthquake damage.
- B. Water supply control valves shall be electrically supervised and mechanically locked for proper position. Water flow and supervisory circuits shall be in accordance with the requirements of electrical specifications. Electric connections to sprinkler system shall be by Division 26. Furnish wiring diagrams for all equipment.
- C. Fire Department Connection: A system fire department connection shall be provided on the system riser in accordance with N.F.P.A. 13. Fire department connection shall be installed in an area accessible for the first response unit. Coordinate with local fire department.
- D. A sprinkler head wrench of each style and model installed shall be provided to the owner at the completion of the project. A representative sampling of each sprinkler head style and model shall be provided to the owner and housed in a sprinkler head cabinet at or near the sprinkler riser. The number of sprinkler heads provided to the owner shall be in accordance with NFPA 13.
- E. Provide "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13
- F. Provide a vent near a high point in the system to allow air to be removed from that portion of the system.

3.07 SPRINKLER INSTALLATION

- A. Provide sprinklers in suspended ceiling in center of all ceiling tiles.
- B. Provide sprinklers in suspended ceilings in center of 2 X 2 ceiling tiles (not required for 2 X 4).
- C. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space per NFPA 13.
- D. Provide sprinkler piping with drains for complete system drainage.
- E. Hangers and Supports: Comply with NFPA 13 for hanger materials.

3.08 LABELING AND IDENTIFICATION

- A. Provide labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

3.09 FIELD QUALITY CONTROL

- A. Flush, test, and inspect sprinkler piping according to NFPA 13, "System Acceptance" Chapter.

- B. Verify that specialty valves, trim, fittings, controls, and accessories are installed and operate correctly.
- C. Verify that specified tests of piping are complete.
- D. Verify that damaged sprinklers and sprinklers with paint or coating not specified are replaced with new, correct type.
- E. Verify that sprinklers are correct types, have correct finishes and temperature ratings, and have guards as required for each application.
- F. Verify that potable-water supplies have correct types of backflow preventers.
- G. Verify that fire department connections have same type compatible with local fire department equipment.
- H. Replace piping system components that do not pass test procedures and retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.
- I. Fill wet-pipe sprinkler piping with water.
- J. Energize circuits to electrical equipment and devices.
- K. Coordinate with fire alarm tests. Operate as required.
- L. Preaction Testing: Test per manufacturer's instructions.
 - 1. Water supply.
 - 2. Alarm line.
 - 3. Ball drip valve.
 - 4. System pneumatic pressure.
 - 5. Releasing device.
 - 6. Testing alarms.
 - 7. Operational tests.

3.10 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers having paint other than factory finish.
- C. Clean and disinfect fire-suppression water-service piping as follows:
 - 1. Purge new piping systems and parts of existing systems that have been altered, extended, or repaired before use.
 - 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.

3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651.
4. Prepare reports.

3.11 PAINTING

- A. Painting of fire-suppression systems, equipment, and components is specified in Division 9.
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.12 PROTECTION

- A. Protect sprinklers from damage until Substantial Completion.

END OF SECTION

SECTION 22 11 16
DOMESTIC WATER PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 23 Section: "Common Work Results"
 - 2. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. This Section includes domestic water piping and specialties.

1.03 ACTION SUBMITTALS

- A. Product Data: For domestic water piping, fittings, valves and accessories.
- B. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.

1.04 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with the local building and plumbing codes.
- C. Qualify brazing processes for copper and copper alloy pipe and tube according to ANSI/AWS C3.4.
- D. Comply with NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances" and NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for combined fire-protection and domestic water service piping to building.
- E. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."
- F. Comply with NSF 372 for low lead.

PART 2 - PRODUCTS

2.01 COPPER TUBING

- A. Hard Copper Tube: ASTM B 88, Types L, water tube, drawn temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
 - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
 - 4. Copper-Tubing, Keyed Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.
- B. Mechanically formed copper tee connections are not acceptable.
- C. Viega Pro Press Fittings: Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed or an alternative supplied by fitting manufacturer. Press ends shall have SC (Smart Connect) feature design (leakage path). The Smart Connect Feature shall assure leakage of liquids and/or gases from inside the system past the sealing element of an un-pressed connection. The function of this feature is to provide the installer quick and easy identification of connections which have not been pressed prior to putting the system into operation.

2.02 VALVES & STRAINERS

- A. Ball Valves
 - 1. The valve body and adapter shall be constructed using Lead Free brass. Lead Free ball valves shall comply with state codes and standards, where applicable, requiring reduced lead content.
 - 2. ½" to 2" ball valves: 2-piece full port lead-free brass ball valves: The valve must have a blowout proof pressure retaining 316 stainless steel stem, 316 stainless steel ball, virgin PTFE seats, seals, stem packing seal and thrust washer. Valve must have adjustable packing. Valves with O-ring stem seal only are not acceptable. Pressure rating no less than 600psi WOG non-shock, 150psi WSP. Valve shall be manufactured to the MSS-SP-110 standard and shall be a Watts Series LFB6080 (threaded) or LFB6081 (solder).
 - 3. Valve sizes 2-½" to 4" threaded, shall be rated to 400psi WOG non-shock and 125psi WSP. Valve sizes 2-½" to 3" solder shall be rated to 400psi WOG non-shock and 125psi WSP. Valve shall be a Watts Series LFFBV-3C (threaded) or LFFBVS-3C (solder).
 - 4. Provide locking handle where indicated.
 - 5. Comply with MSS SP-110.
- B. Swing check valves:
 - 1. Construct pressure containing parts of Valves as follows: Bronze Valves: 125 or 150 psi: ANSI/ASTM B 62; Iron Body Valves: ANSI/ASTM A-126, Grade B.
 - 2. Check valves shall be lead free.
 - 3. Comply with the following standards for design, workmanship, material and testing: Bronze Valves: MSS SP – 80; Cast Iron Valves: MSS SP – 71

4. Construct valves of pressure casting free of any impregnating materials. Construct disc and hanger as one piece. Support hanger pins by removable side plug.
 5. Threaded Ends 2" and Smaller: Class 125, bronze body, screwed cap, Teflon disc.
 6. Soldered Ends 2" and Smaller: Class 125, bronze body, screwed cap, Teflon disc.
 7. Flanged Ends 2-1/2" and Larger: Class 125, iron body, bronze mounted, horizontal swing, cast-iron disc.
- C. Y-type strainer (3" and smaller) Wye-pattern Lead Free Bronze (cast copper silicon alloy strainer) shall be domestically manufactured and conform to Buy American Act standards. The strainer must have a solid retainer cap with gasket. Strainer shall be rated to 400psi (27.6 bar) WOG @ 210°F; 125psi WSP @ 353°F for sizes 1/4"- 3". The strainer screen shall be 304 stainless steel, 30 mesh. Strainer shall be a Watts Series LF777 (threaded ends) or LFS777 (solder ends).
- D. Ball-Valve-Type, Hose-End Drain Valves:
1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
 2. Pressure Rating: 400-psig minimum CWP.
 3. Size: NPS 3/4.
 4. Body: Copper alloy.
 5. Ball: Chrome-plated brass.
 6. Seats and Seals: Replaceable.
 7. Handle: Vinyl-covered steel.
 8. Inlet: match piping.
 9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.03 BACKFLOW PREVENTERS

- A. Manufacturers:
1. Zurn Industries, Inc.; Wilkins Div.
 2. Cla-Val Co.
 3. Apollo
 4. Febco Backflow Preventers.
 5. Watts Industries, Inc.
 6. Ames
- B. General: ASSE standard, backflow preventers.
1. NPS 2 and Smaller: Bronze body with threaded ends.
 2. NPS 2-1/2 and Larger: Bronze, cast-iron, steel, or stainless-steel body with flanged ends.
 3. Interior Components: Corrosion-resistant materials. AWWA C550 or FDA-approved
 4. Exterior Finish: manufacturer's standard.
 5. Provide ball valves on inlet and outlet
 6. Provide strainer on inlet.
 7. All components shall be lead free.
- C. Atmospheric-Type Vacuum Breakers: ASSE 1001, with floating disc and atmospheric vent.
- D. Double-Check Backflow Prevention Assemblies:
1. Watts 007M2QT-S (2" and smaller)
 2. Watts LF709-OSY (2-1/2" and larger)

3. ASSE 1015, suitable for continuous pressure application. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
- E. Reduced-Pressure-Principle Backflow Preventers: ASSE 1013, suitable for continuous pressure application. Pressure Loss: 12 PSIG maximum, through middle 1/3 of flow range.
 1. Provide air gap fitting.
 2. Watts 009-FS - (2" and smaller)

2.04 WATER PRESSURE-REDUCING VALVES

- A. Manufacturers:
 1. Watts
 2. Zurn
 3. Cashco, Inc.
 4. Cla-Val Co.
 5. Conbraco Industries, Inc.
 6. FLOMATIC Corp.
 7. Honeywell Braukmann.
 8. IMI Cash Valve.
- B. Provide a strainer upstream of each regulator.
- C. Water Regulators – for plumbing fixtures and equipment:
 1. Standard: ASSE 1003.
 2. Pressure Rating: Initial working pressure of 150 PSIG.
 3. Body: Bronze with chrome-plated finish for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.

2.05 FLOW SPLITTER

- A. Multi-looped system for providing constant hot water circulation to plumbing fixtures utilizing a dynamic, self-regulating Flow-Splitter valve. Manufacturers: Kemper, or equal.
- B. Kemper Venturi Flow-Splitter Series 651 06 xxx: Lead-free, corrosion resistant red brass dual tee assembly valve with internal, self-adjusting flow regulator including factory loop line ¼ turn shut off valves and factory insulation jacket. When installed per manufacturer's recommendation will provide constant circulating hot water through looped piping to plumbing fixtures to maintain domestic hot water loop temperatures and minimize non-circulating pipe lengths to within required IECC and FGI code specifications.
 1. Low lead, zinc resistant red brass.
 2. Available in sizes from ½" to 2" in the main flow portion of the valve.
 3. Incorporates a dynamic built-in, self-regulating, self-cleaning, flow diverting POM cartridge insert with SS spring and EPDM O-ring.
 4. NSF 61/372 certified.
 5. Configured with female NPT thread connections and 1/4 turn full bore stop valves on loop line connections.
 6. Maximum operating temperature 194°F.
- C. Provide potable water loop circulation system with Flow-Splitter in accordance with construction drawings and factory recommendations. Valve to be installed according to flow direction indicator.

- D. Circulation loop piping from primary hot water source at the Flow-Splitter shall be run to connection points of angle stops serving fixtures and to tub or tub/shower points of connection returning to the Flow-Splitter/hot water source piping. Non-circulation portions of piping shall be no more than 24 inches in length.

2.06 THERMOSTATIC WATER MIXING VALVES

- A. Manufacturers:
 - 1. Armstrong International, Inc.
 - 2. Lawler Manufacturing Company, Inc.
 - 3. Leonard Valve Company.
 - 4. Powers
 - 5. Symmons Industries, Inc.
- B. To prevent scalding, an ASSE-1070 TMV shall be provided for hand wash sinks, lavatories, and bathtubs. A separate TMV is not required if a code-compliant TMV is built-in to the faucet. Set at 110°F. Install as close as practical to the point of use.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Industries, LLC; Wilkins; Model ZW3870XLT (Lead-Free) or Model ZW1070XL (Lead-Free).
 - 2. Standard: ASSE 1070, thermostatically controlled, water tempering valve.
 - 3. Pressure Rating: 125 PSIG.
 - 4. Body: Bronze body with corrosion-resistant interior components.
 - 5. Temperature Control: Adjustable 95-115°F
 - 6. Inlets and Outlet: Threaded.
 - 7. Finish: Rough or chrome-plated bronze.
 - 8. Tempered-Water Design Flow Rate: 0.35 GPM minimum.
 - 9. An ASSE-1017 TMV shall be provided at the water heater (water stored at 140°F) to
- C. Thermostatic tempering valve shall be constructed using lead free brass material which shall comply with state codes and standards, where applicable, requiring reduced lead content. The valve shall feature advanced paraffin-based actuation technology and union connections for ease of maintenance. All internal components shall be corrosion-resistant. Valve shall feature integral checks to prevent cross-flow and inlet screens to filter out debris. The valve shall be ASSE 1017 certified, IUPC certified and approved to CSA B125.3.
 - 1. Capacity of the valve shall be 23.0 GPM 45psi differential.
 - 2. Valve shall perform to a minimum flow of 0.5 GPM to ASSE 1017. Control temperature shall be adjustable between 90 - 160°F.
 - 3. The valve shall feature a vandal-resistant lockable handle to prevent tampering.
 - 4. The valve shall be a Powers HydroGuard Model LFLM 492-1.

2.07 DHW RECIRCULATION BALANCING VALVES

- A. Provide as part of the potable hot water recirculation system in accordance with construction drawings and factory recommendations. Balancing valve shall be installed on domestic hot water return piping downstream of the last fixture with suitable access panel as required in non-accessible ceilings and walls.
- B. ThermOmegaTech "Circuit Solver"; Caleffi "Thermosetter", Viega, Kemper, or approved equal.

1. Balancing valves shall be self-contained and fully automatic without additional piping or control mechanisms.
2. Balancing valves shall regulate the flow of recirculated domestic hot water based on water temperature entering the valve regardless of system operating pressure.
3. When fully closed valve shall bypass a minimum flow to maintain dynamic control of the recirculating loop and provide a means for system sanitizing.
4. Valve shall be factory adjustable from 105°F to 140°F as required by project conditions. Valve shall modulate between open and closed position within a 10°F range.
5. Provide the CSUSF model that allows for an additional balancing cycle at 170°F. The valve shall start to re-open above the low temperature balancing set point to allow the system to rebalance at the sanitizing flush temperature.
6. Valve body and all internal components shall be constructed of stainless steel with major components constructed of type 303 stainless steel.
7. Valve shall be rated to 200 PSIG maximum working pressure. Valve s shall be rated to 300°F maximum working temperature.
8. Valves shall be standard tapered female pipe thread, NPT.
9. Valve shall be ANSI/AWWA C800 compliant and shall be NSF-61 certified with zero lead content for use in all domestic water systems.
10. Thermal actuator shall be spring operated and self-cleaning, delivering closing thrust sufficient to keep orifice opening free of scale deposits. Thermal actuator shall be rated for a minimum of 200,000 cycles.

C. Provide the following with the balancing valves either built-in:

1. Upstream: shutoff valve and 20-mesh strainer.
2. Downstream: shutoff valve and threaded temperature port with threaded plug.

2.08 WATER HAMMER ARRESTORS

- A. Manufacturers:
1. Watts
 2. Oatey
 3. Precision Plumbing Products, Inc.
 4. Sioux Chief
 5. Zurn
- A. Watts LF15M2-DR Series: lead-free, pre-charged copper water hammer arrestor with polypropylene piston, EPDM O-ring seal, and brass NPT threaded connection. ASSE Listed 1010, ANSI A112.26.1, PDI Listed WH-201. The device shall be pre-charged and sealed at the factory.

PART 3 - EXECUTION

3.01 PIPING APPLICATIONS

- A. Pressure Rating: Provide components having a pressure rating equal to or greater than the system operating pressure.
- B. Mechanically formed tee-branch outlets and brazed joints shall not be used.
- C. Underground Domestic Water Service Piping: Provide per local water district construction specifications and procedures, and civil specifications.

- D. Aboveground Domestic Water or Non-Potable Water Piping: Use the following piping materials for each size range:
1. NPS 1 and Smaller: Type L copper
 2. NPS 1-1/2 to NPS 3: Type L copper

3.02 VALVES

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
1. Shutoff Duty: Use bronze ball valves for piping NPS 3 and smaller.
 2. Throttling Duty: Use bronze ball or globe valves for piping NPS 3 and smaller.
 3. Hot-Water-Piping, Balancing Duty.
 4. Drain Duty: Hose-end drain valves.
- B. Provide sectional valve close to water main on each branch and riser serving plumbing fixtures or equipment.
- C. Provide shutoff valve on each water supply to equipment and specialties. Provide shutoff valve on each water supply to plumbing fixtures without supply stops.
- D. Provide shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside building at each domestic water service.
- E. DHW Recirculation Balancing Valves:
1. Provide DHW recirculation balancing valves in each domestic hot water return piping branch beyond last hot water device in that branch.
 2. Provide suitable line size isolation valves, unions, and strainer.
 3. Provide suitable access panel as required in non-accessible ceilings and walls.

3.03 PIPING & SPECIALTIES INSTALLATION

- A. Refer to Division 23 Section "Common Work Results" for installation of:
1. Basic piping requirements.
 2. Joint construction requirements.
 3. Hanger, support, and anchor devices.
 4. Firestopping
 5. Sleeves and Escutcheons
 6. Wall penetration system at each service pipe penetration through foundation wall.
 7. Dielectric fittings
 8. Valves
 9. Identification
- B. Provide underground ductile-iron piping according to AWWA C600 and NFPA 24.
- C. Provide aboveground domestic water piping level and plumb, free of sags, kinks, and bends.
- D. Provide piping with no dead legs, all sections shall see water flow.

- E. Swing Connections for Expansion: Connect hot water risers and branch connections to mains with at least five pipe fittings, including tee in main.
- F. Provide air vents at piping high points. Include ball valve in inlet.
- G. Provide water-pressure regulators for municipal water supplies that exceed 80 psi. Set outlet pressure at 80 psig maximum.
- H. Provide pressure regulators with inlet strainer and shutoff valve, outlet shutoff valve and balance valve bypass. Provide pressure gages on inlet and outlet. Set field-adjustable pressure set points of water pressure-reducing valves.
- I. Water hammer arrestors shall be installed at solenoid valves, and flush valve water closets as shown on the plans and as recommended by Plumbing & Drainage Institute Standard PDI-WH-201. Locate units at the end of branch lines, between the last two fixtures served. Size units based on fixture unit total of branch. All branch pipes serving flush valve water closets shall have water hammer arrestors.
- J. An ASSE-1017 DMV shall be provided for the main domestic hot water distribution loop (water stored at 140°F) to reduce water temperature as shown on the construction drawings; the blended water temperature shall be high enough to maintain a minimum of 120°F throughout the distribution system, to the point of use, and in the return pipe to the water heater.
 - 1. Provide field-required electrical connections.
 - 2. Provide integral check valves on hot and cold inlets to prevent cross flow.
- K. To prevent scalding, an ASSE-1070 TMV shall be provided for hand wash sinks, lavatories, and bathtubs. A separate TMV is not required if a code-compliant TMV is built-in to the faucet. Set at 110°F. Install as close as practical to the point of use.
- L. Provide backflow preventers in each water supply to hydronic systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 - 1. Locate backflow preventers in same room as connected equipment or system.
 - 2. Provide drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
 - 3. Do not install bypass piping around backflow preventers.
 - 4. Access shall be provided for testing, maintenance, and repair. Locate backflow preventer between 2 feet and 5 feet above floor.

3.04 FIELD QUALITY CONTROL

- A. Provide and test all systems per local code requirements.
- B. Perform the following steps before operation:
 - 1. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.
 - 2. Close drain valves, hydrants, and hose bibbs.
 - 3. Open shutoff valves to fully open position.
 - 4. Open throttling valves to proper setting.

5. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
- C. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.
- D. Check plumbing specialties and verify proper settings, adjustments, and operation.
- E. Test plumbing specialties according to authorities having jurisdiction and the device's reference standard. Domestic water piping specialties will be considered defective if they do not pass tests and inspections. Prepare test and inspection reports.
- F. Adjust each backflow preventer in accordance with manufacturer's written instructions, authorities having jurisdiction and the device's reference standard. Backflow prevention assembly shall be tested using gauges specifically designed for the testing of backflow prevention assemblies. Gauges shall be tested annually for accuracy in accordance with the USC's Foundation of Cross Connection Control and Hydraulic Research or the American Water Works Association Manual of Cross Connection (Manual M-14).
- G. Provide factory startup, test, and check:
1. Digital water mixing valve.
 2. DHW recirculation pump control.
- H. Inspect domestic water piping as follows:
1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
 2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- I. Test domestic water piping as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 2. Leave uncovered and unconcealed new, altered, extended, or replaced domestic water piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 3. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

4. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.05 CLEANING

- A. Clean interior of domestic water piping system. Remove dirt and debris as work progresses. Clean and disinfect domestic water piping per code requirements or administrative authority requirements. Sample procedure as indicated:
 1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following: Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours. Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.

END OF SECTION

SECTION 22 13 16

PLUMBING SANITARY AND STORM PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
 - 1. Appendix B: DOC Standard Terms and Conditions (BABAA).
- B. Related Sections include the following:
 - 1. Division 22 Section: "Common Work Results"

1.02 SUMMARY

- A. This Section includes piping and specialties.
 - 1. Drainage and vent.
 - 2. Storm-drainage.
 - 3. HVAC condensate waste.
- B. Drawings show the general layout of piping and accessories but do not show all required fittings and offsets that may be necessary to connect piping to equipment and to coordinate with other trades. Fabricate piping based on field measurements. Provide all necessary fittings and offsets.
- C. General layout shown, provide piping to fixtures as required by the local plumbing code. A licensed master plumber shall perform or supervise the work and provide layouts, piping, and fittings as required by code.

1.03 PERFORMANCE REQUIREMENTS

- A. Comply with the utility requirements for the connection of to the municipal utility services. Obtain and pay for all necessary permits from the applicable municipal department. Obtain authority to connect to their existing mains.
- B. Provide components and installation capable of producing piping systems with working-pressure ratings per local plumbing code.

1.04 SUBMITTALS

- A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections.

- B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.

1.05 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with the local building and plumbing codes.

PART 2 - PRODUCTS

2.01 CAST-IRON SOIL PIPING

- A. Hubless
 - 1. Hubless Cast Iron pipe and fittings shall be manufactured from gray cast iron and shall conform to ASTM A-888 and CISPI Standard 301. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.
 - 2. Hubless couplings shall conform to ASTM C-1540 heavy duty couplings.
 - 3. Gaskets shall conform to ASTM C-564. All pipe and fittings to be produced by a single manufacturer and are to be installed in accordance with manufacturer's recommendations and local code requirements.
 - 4. Couplings shall be installed in accordance with the manufacturer's band tightening sequence and torque. Tighten bands with a properly calibrated torque limiting device.
- B. Hub and Spigot Cast Iron Soil Pipe and Fittings:
 - 1. Hub and Spigot Cast Iron pipe and fittings shall be manufactured from gray cast iron and shall conform to ASTM A-74. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute. Pipe and fittings to be Extra Heavy (XH).
 - 2. Joints can be made using a compression gasket manufactured from a neoprene elastomer meeting the requirements of ASTM C-1563 or lead and oakum. All pipe and fittings to be produced by a single manufacturer and are to be installed in accordance with manufacturer's recommendations and local code requirements. The system shall be hydrostatically tested after installation to 10 ft. of head (4.3 psi maximum).

2.02 PVC DRAINAGE PIPING

- A. Pipe and fittings shall be manufactured from PVC compound with a cell class of 12454 per ASTM D-1784 and conform with National Sanitation Foundation (NSF) standard 14. Pipe shall be iron pipe size (IPS) conforming to ASTM D-1785 and ASTM D-2665. Fittings shall conform to ASTM D-2665.
- B. All pipe and fittings to be produced by a single manufacturer and to be installed in accordance with manufacturer's recommendations and local code requirements. Solvent cements shall conform to ASTM D-2564, primer shall conform to ASTM F-656. The system to be manufactured by Charlotte Pipe and Foundry Co. or approved equal; and shall be intended for non-pressure drainage applications where the temperature will not exceed 140°F.

- C. Solvent cement joints for PVC pipe and fittings shall be clean from dirt and moisture. Pipe shall be cut square and pipe shall be deburred. Where surfaces to be joined are cleaned and free of dirt, moisture, oil and other foreign material, apply primer in accordance with ASTM F656.

2.03 COPPER TUBE AND FITTINGS

- A. Copper Type DWV Tube: ASTM B 306, drainage tube, drawn temper.
- B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- C. Hard Copper Tube: ASTM B 88, Type L and Type M, water tube, drawn temper.
- D. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.
- E. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.04 PVC PRESSURE PIPING

- A. All pipe and fittings to be produced by a single manufacturer and to be installed in accordance with manufacturer's recommendations and local code requirements. Solvent cements shall conform to ASTM D-2564, primer shall conform to ASTM F-656. The system to be manufactured by Charlotte Pipe and Foundry Co. and is intended for pressure applications where the temperature will not exceed 140°F.
- B. Solid Wall: Pipe and fittings shall be manufactured from PVC compound with a cell class of 12454 per ASTM D-1784 and conform with National Sanitation Foundation (NSF) standards 14 and 61. Pipe shall be iron pipe size (IPS) conforming to ASTM D-1785. Fittings shall conform to ASTM D-2466.

2.05 AUTOMATIC CONDENSATE PUMP UNITS

- A. Manufacturers:
 - 1. Blue Diamond
 - 2. Refco
 - 3. Little Giant
 - 4. Sauermann
 - 5. Marsh
- B. The pumps shall be of the high efficiency type specifically designed for quiet operation.
 - 1. Pump Housing: ABS Material
 - 2. O-Ring: EPDM
 - 3. Bearing: Carbon/Alumina Ceramic
 - 4. Impeller: Nylon/PPO
 - 5. Motor: High Efficiency ECM
 - 6. All Other Wetted Parts: Type 316 Stainless Steel
 - 7. Shaft-less, seal-less construction
 - 8. Pump to be suitable for 140°F operation.
 - 9. Green LED to indicate when pump is operating
 - 10. Tank Volume: 0.184 gallons total (0.132 gallons usable)

11. Main cable with shock-proof plug
- C. Provide condensate removal pumps come as a kit ready for installation. Kits shall include:
1. Condensate Pump
 2. Mounting bracket (designed for rear wall or left side wall mounting)
 3. Pressure hose connection kit
 4. Pressure hose: 19 feet length.
 5. Non-return valve.
 6. Tank
 7. All required connections and fitting.

2.06 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

- A. Open Drains:
1. Description: Pipe fittings assembled to make a trapped receptacle like a floor drain but usually without a grate. They are installed with the top above the floor level, so they are not a substitute for a floor drain.
 2. Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
 3. Size: Same as connected waste piping with increaser fitting of size indicated.
- B. Deep-Seal Traps:
1. Description: P-traps that are made with a deeper-than-normal water seal.
 2. Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
 3. Size: Same as connected waste piping. NPS 2: 4-inch-minimum water seal. NPS 2-1/2 and Larger: 5-inch-minimum water seal.
- C. Stack Flashing Fittings:
1. Description: devices for flashing around vent piping at roof penetrations.
 2. Counter flashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
 3. Size: Same as connected stack vent or vent stack.
- D. Expansion Joints: telescoping pipe fittings that permit the contraction or expansion movement of vertical stacks. Standard: ASME A112.21.2M. Body: Cast iron with bronze sleeve, packing, and gland.
- E. Provide backwater valves in piping subject to sewage backflow and as required by plumbing code. For interior installation, provide cleanout deck plate flush with 2 keys. Provide floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing. Watts BV-200 ASME A112.14.1, cast-iron body, hub inlet and offset spigot outlet, bolted cover with gasket, automatic bronze seat and flapper type backwater valve.

2.07 CLEANOUTS

- A. Manufacturers

1. Zurn
 2. Smith, Jay R. Mfg. Co.
 3. Josam Co.
 4. Tyler Pipe, Wade Div.
 5. Watts Industries, Inc., Drainage Products Div.
 6. Mifab
 7. Wade
- B. Provide per plumbing code.
- C. Cleanouts shall meet BABAA.
- D. Cleanouts shall be easily accessible and shall be gastight and watertight. Provide a minimum clearance of 24 inches for the rodding. Size of cleanout shall be same as pipe size through 4". Pipes 4" and larger shall have 4" cleanouts.
- E. Basis of Design Watts CO-200-R
1. Compliance: ANSI/ASME A112.36.2M.
 2. Load Rating: MD - Safe Live Load 2,000-4,999 lbs.
 3. Epoxy coated cast iron floor cleanout with 5" round adjustable gasketed nickel bronze top, removable gas tight gasketed brass cleanout plug, and no hub (standard) outlet.
 4. When a waterproof membrane is used in the floor system, provide clamping collars on the cleanouts.
 5. In carpeted areas, provide carpet cleanout markers.
 6. Round, square, or recessed for tile tops as required.
 7. Provide vandal secured top when scheduled.
- F. Cleanouts shall consist of "Y" fittings and (1/8 inch) bends with brass or bronze screw plugs.
- G. Provide cleanouts at or near the base of the vertical stacks with the cleanout plug located approximately 24 inches above the floor. If there are no fixtures installed on the lowest floor, the cleanout shall be installed at the base of the stack. Cleanout shall consist of sanitary tees. . Extend the cleanouts to the wall access cover; Zurn 1400 Series.
- H. In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/no hub cast iron ferrule. Plain end (no-hub) piping in interstitial space or above ceiling may use plain end (no-hub) blind plug and clamp.

2.08 FLOOR DRAINS

- A. Manufacturers
1. Zurn Industries, Inc
 2. Jay R. Smith Mfg. Co.
 3. Tyler Pipe, Wade Div.
 4. Watts Industries, Inc
 5. Josam
 6. Wade
- B. Floor drains shall comply with ASME A112.21.1M. Provide outlet type as required by piping system used.
- C. Provide 1/2" trap primer connection as indicated on plans.

- D. Floor drains shall meet BABAA.
- E. FD-1: Epoxy coated cast iron floor drain with anchor flange, reversible clamping collar with primary and secondary weepholes, post-pour adjustable round heel proof nickel bronze strainer with integrated bubble level, leveling shims, and no hub (standard) outlet.
 - 1. Provide vandal secured top as scheduled.
 - 2. Round: Round: Josam 30000-A
 - 3. Square: Josam 30000-S provide for tile floors.
- F. FD-2: mechanical rooms; Josam 32100 Series, Epoxy coated cast iron area drain with anchor flange, weepholes, 8" diameter fixed top with heel proof ductile iron grate.

2.09 TRAP SEAL PRIMER VALVES

- A. Manufacturers:
 - 1. Precision Plumbing Products, Inc.
 - 2. Josam Co.
 - 3. Watts.
 - 4. Zurn
 - 5. Mifab
 - 6. Sioux Chief
- B. Trap primer make up lines shall have a continuous slope to the floor drain.
- C. Electronic Trap Primer – TP-1
 - 1. Precision Plumbing Products Model MP-500
 - 2. Operation: A preset timer energizes a normally closed electronic solenoid valve. Potable water flows across the air gap and is distributed via trap primer feed lines. The timer then de-energizes the solenoid allowing it to close until the next operational cycle.
 - 3. Cabinet: Surface-mounted steel box; NEMA Type 1, UL 50, 12" x 12" x 4" - 16-gauge steel w/screw on cover ANSI 61 gray polyester powder paint.
 - 4. Electric Controls: Pre-set timer opens once for 6 seconds every 24hours. 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. 120/1/60, 0.23 Amps. Circuit Breaker, Test Switch, Timer, Solenoid Valve UL Listed. Electrical assembly listed per UL # 73.
 - 5. Air gap fitting
 - 6. Solenoid valve with integral strainer screen
 - 7. Piping: ASTM B 88, Type L copper water tubing. 95-5 lead-free. Containing lead not in the excess of 0.2%; Inlet: ½" NPT male; Outlet: ½" NPT female.
 - 8. Provide a distribution unit for multiple outlet installations.
 - 9. Standard: ASSE 1044.
- D. Automatic Trap Seal Primer – TP-3:
 - 1. MIFAB M-500 Series; pressure activated trap seal primers (MR-500-NPB, M1-500-NPB and M2-500-) can be connected to any cold-water line and shall be automatically activated when a valve or faucet, that is on the line, is opened.
 - 2. A pressure drop of three (3) PSI shall activate the trap seal primer. A 5 PSI activation level is not acceptable

3. Trap seal primers can be disassembled in the field. The design shall permit filter replacement without affecting the performance of the primer. The "O" ring seals shall be tested for reliability at a temperature range of -40 degrees to 450 degrees F.
4. The trap seal primer shall not require adjustment.
5. Standard: ASSE 1018; lead free.
6. Provide a ball valve upstream of the trap primer.
7. Provide an "MI-GAP" air gap fitting with 1/2" male inlet and 1/2" female outlet; built-in 1" air gap.

PART 3 - EXECUTION

3.01 SITE INTERFACE

- A. Provide piping from inside face of exterior wall to a distance of approximately 5 feet outside of building. Provide flanged and anchored connection to interior piping.
- B. Refer to Division 31 for excavating, trenching, and backfilling.

3.02 PIPING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Aboveground and Underground, Soil, Waste, and Vent Piping: Use any of the following piping materials for each size range:
 1. Cast iron
 - a. Risers/stacks
 - b. Acoustics: Waste or storm piping within classrooms.
 - c. Exposed to finished space
 - d. Above ground drainage, waste, and vent piping.
 - e. Piping in return air plenums. The first floor is all return air plenum, all sanitary waste, vent, and drainage piping on this floor shall be cast iron.
 2. PVC
 - a. Under slab
 3. Vent Piping through roof/exposed above roof: Use any of the following piping materials for each size range:
 - a. Cast iron
- C. HVAC Unit Condensate Indirect Waste: Drain Lines: 3/4" minimum diameter; DWV Copper Tubing: ASTM B 306, Type DWV. PVC drain lines shall not be used in return air plenums.

3.03 PIPING INSTALLATION

- A. Refer to Division 23 Section "Common Work Results" for installation of:
 1. Basic piping requirements.
 2. Joint construction requirements.
 3. Hanger, support, and anchor devices.
 4. Firestopping

5. Sleeves and Escutcheons
 6. Wall penetration system at each service pipe penetration through foundation wall.
 7. Dielectric fittings
 8. Valves
 9. Mechanical Identification
- B. Provide 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. Make joints according to CISPI.
 2. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
 3. Hubless Joints: Make with rubber gasket and sleeve or clamp.
- C. Provide PVC soil and waste drainage and vent piping according to ASTM D 2665.
- D. Provide underground PVC soil and waste drainage piping according to ASTM D 2321.
- E. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling. Aboveground Pressure Piping: Pipe fitting.
- F. Flexible Transition Couplings for Underground Non-pressure Drainage Piping: ASTM C 1173 with elastomeric sleeve; ends same size as piping to be joined, and corrosion-resistant metal band on each end.
- G. Make changes in direction for drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- H. Provide drainage piping beginning at low point of each system. Provide true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Provide required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- I. Provide drainage and vent piping at the minimum slopes as required by the local plumbing code.
- J. Provide cleanouts at grade and extend to where building drains connect to site piping. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

3.04 SYSTEM CONDENSATE DRAIN PIPING

- A. General Requirements for drain piping and tubing:
1. Install a union in piping at each threaded unit connection.
 2. Install an adjustable stainless steel hose clamp with adjustable gear operator on unit hose connections. Tighten clamp to provide a leak-free installation.

3. If required for unit installation, provide a trap assembly in drain piping to prevent air circulated through unit from passing through drain piping. Comply with more stringent of the following:
 - a. Details indicated on Drawings.
 - b. Manufacturer's requirements.
 - c. Governing codes.
 - d. In the absence of requirements, comply with requirements of ASHRAE handbooks.
4. Extend drain piping from units with drain connections to drain receptors as indicated on Drawings. If not indicated on Drawings, terminate drain connection at nearest accessible location that is not exposed to view by occupants.
5. Provide each 90-degree change in direction with a Y- or T-fitting. Install a threaded plug connection in the dormant side of fitting or future use as a service cleanout.
6. Piping shall be equal to or larger than the drain pan connection size.
7. If required by manufacturer for unit installation, provide a trap assembly in drain piping to prevent air circulated through unit from passing through drain piping. Comply with manufacturer's requirements.
8. Route indoor unit condensate drains to sink traps, floor drains, plumbing code compliant, or other locations as indicated.

B. Gravity Drains:

1. Piping shall be provided with a 1/8" foot minimum slope.
2. Height of unit must be carefully coordinated to provide for proper condensate drainage.

C. Pumped Drains:

1. If unit condensate pump or lift mechanism is not included with an integral check valve, install a full-size check valve in each branch pipe near unit connection to prevent backflow into unit.
2. Provide units for collecting condensate and extend to open drain, floor drain, mop sink, or other approved location.
3. Mount pump level, secured to wall.
 - a. Condensate supply hose must be routed with a downward slope to the pump.
 - b. Secure the hose using hose clamps.
 - c. After securing hose on the non-return valve, lock non- return valve by rotating valve one quarter turn clockwise.
4. After installing the condensate pump, test it to ensure that it functions correctly. To test the function, pour water into the tank until the activation level is reached and the pump starts. If air in the pump causes the integrated dry-run protection to actuate (pump deactivates, green and red operating lamp flash), add additional water and re-test.
5. Shutoff Valves: Provide full-port ball valve on each pump discharge.

3.05 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect interior drainage piping to exterior drainage piping.
- C. Connect drainage and vent piping to fixtures and equipment as shown on the plans.
- D. Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
- E. Provide traps on plumbing specialty drain outlets.

- F. Provide expansion joints on vertical risers, stacks, and conductors as required by code.
- G. Cleanouts:
 - 1. Provide cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated: Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated. Locate at each change in direction of piping greater than 45 degrees. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping. Locate at base of each vertical soil and waste stack.
 - 2. Provide cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.
 - 3. Provide cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.
 - 4. Provide flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.
- H. Provide floor drains in accordance with manufacturer's instructions at locations indicated on the drawings.
 - 1. Protect installed floor drains from damage during construction.
 - 2. Provide floor drains at low points of surface areas to be drained. Floor s shall be sloped to floor drains.
 - 3. Provide floor drains plumb, level, and to correct elevation.
 - 4. Ensure top of floor drains are flush with top of finished floor.
 - 5. Provide floor drains using manufacturer's supplied hardware.
 - 6. Coordinate depressed/pitched slab with concrete contractor.
 - 7. Provide floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 - 8. Provide individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- I. Trap primers:
 - 1. Provide floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection. Primers shall be accessible for maintenance.
 - 2. Provide trap seal primers in accordance with manufacturer's instructions.
 - 3. Cycle trap seal primers a minimum of 6 times to ensure optimum performance.
 - 4. Ensure flux and other debris is removed.
 - 5. Do not install trap seal primers closer than 40 feet apart when using same potable water supply line.
 - 6. Mount trap seal primers in a vertical position 1 foot above finished floor for every 20 feet of floor drain trap make-up water line.
 - 7. Provide union connection above trap seal primers.
 - 8. Provide line shut-off valve upstream of trap seal primers to shut off water supply when performing maintenance on trap seal primers.
 - 9. Avoid direct installation to prevent foreign material from entering directly into trap seal primers.

3.06 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Test piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 3. Roughing-in Plumbing Test Procedure: Test piping on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch w.g. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
- C. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
- D. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.
- E. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

3.07 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
 - 1. Appendix B: DOC Standard Terms and Conditions (BABAA).
- B. Related Sections include the following:
 - 1. Division 23 Section "Common Work Results"
 - 2. Division 22 Plumbing Sections

1.02 SUMMARY

- A. This Section includes Plumbing Fixtures.

1.03 SUBMITTALS

- A. Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.
- B. Maintenance Data: For plumbing fixtures to include in maintenance manuals specified in Division 1.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. Comply with the local building and plumbing codes.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; about plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

- E. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for fixture materials that will be in contact with potable water.
- F. Coordinate roughing-in and final plumbing fixture locations and verify that fixtures can be installed to comply with original design and referenced standards.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Common Plumbing Fixture Requirements
 - 1. Vitreous china, nonabsorbent, hard-burned, and vitrified throughout the body shall be provided. Porcelain enameled ware shall have specially selected, acid-resisting enamel coating evenly applied on surfaces. No fixture will be accepted that shows cracks, crazes, blisters, thin spots, or other flaws. Fixture color shall be white except as specified herein.
 - 2. Provide combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
 - 3. Fixtures shall be provided appurtenances such as traps, supplies, faucets, stop valves, and drain fittings – for a complete, finished, code-compliant installation.
 - 4. Coordinate fixture rough in dimensions for conflicts with surrounding structure, prior to submitting.
 - 5. Each fixture and piece of equipment requiring connections to the drainage system shall be equipped with a trap.
 - 6. Brass expansion or toggle bolts capped with acorn nuts shall be provided for supports, and polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view.
 - 7. Fixture supports for off-the-floor fixtures shall be of the chair-carrier type. The carrier shall provide the necessary means of mounting the fixture, with a foot or feet to anchor the assembly to the floor slab. Adjustability shall be provided to locate the fixture at the desired height and in proper relation to the wall. Support plates, in lieu of chair carrier, shall be fastened to the wall structure only where it is not possible to anchor a floor-mounted chair carrier to the floor slab. Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet, bolts and hardware matching fixture.
 - 8. Provide access panels to concealed valves and components. All components shall have proper access in accordance with manufactures' recommendations.
 - 9. Mounting heights: Refer to Architectural Plans.
 - 10. Water line components shall be lead-free.

2.02 FLUSH VALVE WATER CLOSETS

- A. Manufacturers:
 - 1. American Standard
 - 2. Toto
 - 3. Sloan

B. Water Closets - Common Requirements:

1. Comply with ASME A112.19.2 – Ceramic Plumbing Fixtures; Comply with ADA
2. Material: Vitreous china.
3. Type: Siphon jet.
4. Style: Flushometer valve.
5. Rim Contour: Elongated.
6. Support: Water-closet carrier
7. Water Consumption: 1.28 GPF.
8. Spud Size and Location: NPS 1-1/2; top.
9. Toilet Seats: Standard: IAPMO/ANSI Z124.5; solid polypropylene with special surface that inhibits the growth of stain and odor causing bacteria, mold and mildew on the surface; commercial heavy duty; Shape: Elongated rim, open front; Seat Cover: Not required. Color: White.

C. **P-1:** Floor mounted, bottom outlet, top spud. Sloan Crown WETS-2023.1006; Flushometer:



1. Flushometer: Lever-Handle, Exposed, Piston Flushometer Valves: Sloan Crowne
 - a. Comply with ASSE 1037 and ASME A112.19.5, and ADA. Include integral check stop and backflow-prevention device.
 - b. Material: Brass body with corrosion-resistant components. Flushometer Finish: Chrome plated.

2.03 VITREOUS-CHINA LAVATORIES

A. Lavatory Manufacturers:

1. Sloan
2. Zurn
3. American Standard
4. Toto USA

B. Lavatories – Common Requirements:

1. Standard: ASME A112.19.2/CSA B45.1; ADA.
2. Faucet-Hole Punching: Match faucet, coordinate hole locations.
3. Provide a permanent surface that inhibits the growth of stain and odor causing bacteria, mold and mildew on the surface
4. Provide overflow.
5. Provide 304 stainless steel grid drain unless noted otherwise.
6. Risers: Supply line: supplied by fixture manufacturer, or by McGuire or Brasscraft. Shall be lead-free, loose key standard stop lavatory supply kit, two polished chrome, solid brass angle stops with wheel handles, two 12" flexible chrome-plated lavatory risers complete with two forged brass with set screw flanges; connections: 1/2" sweat x 3/8" OD.
7. Waste Fittings: Standard: ASME A112.18.2
8. Drain: Stainless steel grid type with NPS 1-1/4 offset and straight tailpiece.

9. Trap: NPS 1-1/2 by NPS 1-1/4; Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch- thick brass tube to wall; and chrome-plated, brass or steel wall flange.
10. Provide ADA trim kits for exposed piping.
 - a. Piping shield equal to Trubro Lav Shield.
11. Faucets: See LAVATORY & SINK FAUCETS paragraph below.

- C. **P-2: Wall Mounted:** Provide ASME A112.6.1M lavatory carrier. Lavatory mounting height: See architectural plans

1. Sloan "Sloan Tec" SS-3003-STG; Nominal Size: Rectangular, 20.75" x 18.25".



- D. Lavatory Faucets:

1. See faucet specifications in paragraphs hereinafter.
2. Wrist blade
3. ADA lever handles

2.04 STAINLESS STEEL SINKS

- A. Sink Manufacturers:

1. Elkay Manufacturing Co.
2. Just Manufacturing Co.
3. Moen
4. Advance Tabco

- B. Sinks – Common Requirements:

1. Standard: ASME A112.19.2/CSA B45.1; ADA.
2. Faucet-Hole Punching: Match faucet, coordinate hole locations.
3. Risers: Supply line: supplied by fixture manufacturer, or by McGuire or Brasscraft. Shall be lead-free, loose key standard stop lavatory supply kit, two polished chrome, solid brass angle stops with wheel handles, two 12" flexible chrome-plated lavatory risers complete with two forged brass with set screw flanges; connections: 1/2" sweat x 3/8" OD.
4. Waste Fittings: Standard: ASME A112.18.2
5. P-trap: heavy cast brass adjustable body, with slip nut, with cleanout, box flange and seamless tubular wall bend.
6. Grid drains, where indicated, shall be 304SS.
7. Provide ADA trim kits for exposed piping.
 - a. Pipe covering kit equal to Dearborn Safety Series; Cover opens 180° for easy installation, EVA foam material, sized for 1 1/4" and 1 1/2" cast traps, IAPMOPS-94.
8. Faucets: See LAVATORY & SINK FAUCETS paragraph below.

- C. **P-3:** Undermounted counter sink, 18 gauge; type 304 stainless steel. Basis of Design: Just USADA1824A55-J, 23.5" x 18.25" outside dimensions and 21" x 15-3/4" inside dimensions. ADA bowl depth: 5 3/8".
1. Drain Opening: 3-1/2" off centered right location.
 2. Drain: type 304 stainless grid drain
 3. Drain Fitting: type 304 stainless steel body and removable conical basket strainer with metal stem and rubber stopper; fits 3-1/2" opening; polished finish; chrome plated solid brass construction.
 4. Provide mounting hardware.

2.05 LAVATORY & SINK FAUCETS

A. Faucet Manufacturers

1. Moen
2. Symmons
3. Chicago
4. Sloan
5. American Standard

B. Faucets - Common Requirements:

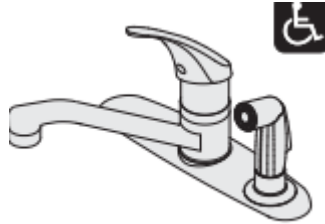
1. Comply with ASME A112.18.1M, NSF372-2011, ADA; UL 1951
2. Body Material: Commercial, solid cast brass.
3. Lead Free: Faucet contains $\leq 0.25\%$ total lead content by weighted average
4. Thermostatic mixing valves (TMV): 20" flexible stainless steel inlet hoses with 3/8" compression fittings. ASSE 1070 certified down to 0.35 GPM

C. Manual Type:

1. **P-2:** Lavatory Faucet: Chicago Faucets No. 3511-4E2805AB, Sink Faucet for hot and cold water, deck-mounted with 4" fixed centers, chrome plated. Integral, cast brass spout, 4" center-to-center. 0.5 GPM vandal-proof, pressure compensating, Econo-Flo, non-aerating spray. Ceramic quarter-turn cartridge, features square, tapered stem. Dual supply for hot and cold water service. Flexible supply hoses included. Concealed, internal temperature control mixer with hot water adjustment limit stop. Includes 4" cover plate kit. ECAST® construction with less than 0.25% lead content by weighted average. This product meets ADA ANSI/ICC A117.1 requirements and is tested and certified to industry standards: ASME A112.18.1/CSA B125.1, Certified to NSF/ANSI 61, Section 9, California Health and Safety Code 116875 (AB1953-2006), Vermont Bill S.152, and NSF/ANSI 372 Low Lead Content.
 - a. Provide ASSE 1070 mixing valve.



2. **P-3:** Sink Faucet: Symmons Kitchen Faucet SK233 Includes single-lever kitchen faucet with red/blue indicators on handle, handle limit stops, 8-3/4" swing spout with aerator, ceramic control components, 3/8" braided supply lines, metal construction, Polished Chrome finish, 1.5 gpm standard flow rate. 10-Year Commercial Warranty. ASME A112.18.1/CSA B125.1, NSF/ANSI/CAN 61: Q
 - a. Provide ASSE 1070 mixing valve.



2.06 EMERGENCY PLUMBING FIXTURES

- A. Manufacturers
 1. Bradley Corporation
 2. Stingray Systems
 3. Guardian Equipment Co.
 4. Haws Corporation.
 5. Speakman Co.
 6. Chicago Faucets
- B. ANSI Standard: Comply with ANSI Z358.1-2009, "Emergency Eyewash and Shower Equipment." Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- C. In an emergency situation one's vision may be impaired. Therefore, emergency equipment requires what ANSI describes as a "highly visible sign." This signage shall be provided in close proximity to the emergency equipment for quick identification. Provide signage per ANSI Z358 requirements.
- D. Deck Mount Hand-Held Hose Spray (**EW-1**) – Bradley Model S19-460EFW



1. Quick-access emergency eye/face spray features soft-flow dual spray-heads for flooding large areas as well as eyes only. Self-coiling hose retracts for easy storage while allowing instant extension in emergency situations. Hand-held hose sprayhead shall contain an antimicrobial agent to protect the sprayhead. Operating range is 30–90 psi. Flow rate is 3.9–5.9 GPM.

2. Eye/Face Spray: Perforated sprayhead is ABS plastic and features soft-flow sprayhead for flooding large areas as well as eyes only. Includes protective sprayhead cover. Integral flow control assures safe, steady flow under varying water supply conditions.
3. Valve: Chrome-plated brass with extended handle stays open once handle is squeezed.
4. Drench Hose: 8' yellow reinforced thermoplastic hose has 3/8" NPT male thread. Burst strength is 450 PSI.
5. Tempering Unit: TMV#01

E. Thermostatic Mixing Valves (TMV)

1. Tepid flushing fluid is considered necessary in all types of emergency equipment applications. Tepid is defined in ANSI Z358 as a flushing fluid temperature conducive to promoting a minimum 15-minute irrigation period. A suitable range is 60°F to 100°F. Generally, temperatures higher than 100 degrees Fahrenheit may cause chemical interactions with the skin and result in further damage. At 60 degrees Fahrenheit and below hypothermia becomes a concern. The Owner's safety/ health advisor shall provide a determination of the best temperature parameters; absent this information, set the temperature at 85°F.
2. Provide a liquid-filled unit-mounted dial thermometer, providing tepid, potable water, maintaining temperature at plus or minus 5°F for required 15-minute test period, and in case of unit failure to continue cold-water flow, with associated corrosion-resistant housing and fittings.
3. TMV #01: Thermostatic Mixing Valve for Eyewash and Eye/Face Wash Units: Basis of Design Manufacturer/Model: Bradley, Navigator Emergency Thermostatic Mixing Valve S19-2000 EFX-8. Supply Connections: 1/2" hot and cold water. Flow Capacity: 7 GPM at 30 psi. Finish: Rough bronze
4. TMV #02: Thermostatic Mixing Valve for Combination Shower Units: Basis of Design Manufacturer/Model: Bradley, Navigator Emergency Thermostatic Mixing Valve S19-2100 EFX-25. Supply Connections: 3/4" Hot and cold water, 1" Outlet. Flow Capacity: 26 GPM at 30 psi. Finish: Rough bronze.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation. Use manufacturer's roughing-in data if roughing-in data are not indicated.
- B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 FIXTURE INSTALLATION - GENERAL

- A. Assemble and support fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Provide fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.

- C. Provide water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Provide stops in locations where they can be easily reached for operation.
- D. Provide traps on fixture outlets as required.
 - 1. Provide level and plumb according to roughing-in drawings.
- E. Provide supports and connections to fixtures per manufacturer's instructions.
- F. Provide escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings.
- G. Set floor mounted fixtures in a leveling bed of cement grout as per fixture manufacturer's instructions.
- H. Joint Sealing: Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to water-closet color. Comply with sealant requirements specified in Division 9.
- I. Wall Flange and Escutcheon Installation: Provide wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork. Provide deep-pattern escutcheons if required to conceal protruding fittings.

3.03 WATER CLOSET INSTALLATION

- A. Provide accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.
- B. Provide flush handle mounted on open (approach) side of fixture. Provide actuators in locations that are easy for people with disabilities to reach.
- C. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
- D. Provide toilet seats on water closets.

3.04 SINKS AND LAVATORIES

- A. Provide supports, affixed to building substrate, for wall-mounted lavatories.
- B. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls. Adjust water pressure at faucets to produce proper flow.

3.05 HOOK UPS

- A. Foodservice Equipment: Provide plumbing hookups per Section 11 40 00 "Foodservice Equipment". Provide rough-in piping, traps, tailpieces, indirect waste lines and make final and necessary connections for foodservice equipment. Provide faucets, spray units, drains, lever drains, vacuum breakers, solenoid valves, check-valves, flow control valves, water inlet fittings, filters, strainers, pressure reducing valves and gas valves furnished by foodservice equipment contractor. Provide condensate drain piping from cooler and freezer evaporators. Make all final and necessary plumbing connections.

- B. Provide plumbing hookups to Fixtures and Equipment Specified in Section 11 31 00 "Residential Appliances". Connect fixtures and equipment with water supplies Use size fittings required to match fixtures and equipment. Connect to plumbing piping.
- C. Residential Dishwasher: When the sink is equipped with a garbage disposal unit, the dishwasher waster shall be connected to the inlet side of the disposal after passing through the required air gap fitting. When the sink is not equipped with a garbage disposal unit, the dishwasher waste shall be connected to the continuous waste of the sink using a wye-branch fitting, after passing through the required air gap fitting. The wye branch fitting may be installed in any vertical section of the continuous waste on the inlet side of the trap. The wye branch fitting shall not be installed in a horizontal run.
- D. Provide disposer in outlet of sinks indicated to have disposer. Provide switch where indicated or in wall adjacent to sink if location is not indicated.
- E. Provide hot-water dispensers in back top surface of sink or in counter with spout over sink.

3.06 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view. Plain copper tube, fittings, and valves may be used in concealed locations.
- C. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.

3.07 FIELD QUALITY CONTROL

- A. Verify that installed fixtures are categories and types specified for locations where installed. Check that fixtures are complete with trim, faucets, fittings, and other specified components. Inspect installed fixtures for damage. Replace damaged fixtures and components.
- B. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves. Adjust set point within allowable temperature range.
- D. Operate and adjust fixtures. Replace damaged and malfunctioning fixtures, fittings, and controls.
- E. Adjust water pressure to produce proper flow and stream.
- F. Replace washers and seals of leaking and dripping faucets and stops.

3.08 CLEANING

- A. After completing fixture installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean fixtures and other fittings with manufacturers' recommended cleaning methods and materials. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts. Remove sediment and debris from drains.
- C. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

3.09 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of fixtures for temporary facilities unless allowed in Division 1.

END OF SECTION

SECTION 22 63 13

MEDICAL AIR SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 23 Section: "Common Work Results"
 - 2. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. Section includes medical gas and vacuum piping and components.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Simulated Medical oxygen operating at 50 to 55 psig.
 - 1. Note: there is no oxygen in this project, compressed air will be used as a surrogate.
- B. Simulated Medical air operating at 50 to 55 psig.
 - 1. Note: There is no medical grade air in this project, but house compressed air will be used as a surrogate.

- C. Compliance with NFPA 99 is not required. This facility will never have human patients.

2.02 PIPES, TUBES, AND FITTINGS

- A. Comply with ASME B31.1 for laboratory air piping operating at more than 150 psig.
- B. Copper Medical Gas Tube: ASTM B819, Type L, seamless, drawn temper.
- C. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type.
- D. Copper Unions: ASME B16.22 or MSS SP-123, wrought-copper or cast-copper alloy.
- E. Copper Pressure-Seal Fittings: Wrought-copper fitting with EPDM O-ring seal in each end.
- F. Flexible Pipe Connectors: Description: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - 1. Working-Pressure Rating: 200 psig minimum.
 - 2. End Connections: Plain-end copper tube.
- G. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys.

2.03 VALVES

- A. Ball Valves:
 - 1. Standard: MSS SP-110.
 - 2. Description: Three-piece body, brass, or bronze.
 - 3. Pressure Rating: 300 psig minimum.
 - 4. Ball: Full-port, chrome-plated brass.
 - 5. Seats: PTFE or TFE.
 - 6. Handle: Lever type with locking device.
 - 7. Stem: Blowout proof with PTFE or TFE seal.
 - 8. Ends: manufacturer-installed ASTM B819, copper-tube extensions with pressure gauge on one copper-tube extension.
- B. Check Valves:
 - 1. Description: In-line pattern, bronze.
 - 2. Pressure Rating: 300 psig minimum.
 - 3. Operation: Spring loaded.
 - 4. Ends: Manufacturer-installed ASTM B819, copper-tube extensions.
- C. Pressure Regulators:
 - 1. Spring-loaded, diaphragm-operated, relieving type.
 - 2. Manual pressure-setting adjustment.
 - 3. Rated for 250-psig minimum inlet pressure.
 - 4. Capable of controlling delivered gas pressure within 0.5 psig for each 10-psig inlet pressure.

2.04 MEDICAL GAS OUTLETS

- A. Connect to the patient room headwall modular service assembly as shown on the architectural plans. Coordinate with Section 117001 "Medical Equipment".

2.05 AIR COMPRESSOR EQUIPMENT

- A. Provide a new air filter for air compressor, sized to meet the existing compressor's manufacturer's installation requirements and recommendations.

PART 3 - EXECUTION

3.01 INSTALLATION OF PIPING

- A. General Location and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of gas piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Provide piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Provide piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- C. Provide 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. Provide piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- E. Provide piping adjacent to equipment and specialties to allow service and maintenance.
- F. Provide nipples, unions, special fittings, and valves with pressure ratings same as or higher than system pressure rating used in applications specified in "Piping Schedule" Article unless otherwise indicated.
- G. Provide piping to permit valve servicing.
- H. Provide piping free of sags and bends.
- I. Provide fittings for changes in direction and for branch connections.
- J. Provide service connections recessed in walls. Attach roughing-in assembly to substrate; attach finishing assembly to roughing-in assembly.
- K. Connect gas piping to gas sources and to gas outlets and equipment requiring gas service.
- L. Provide unions in copper tubing adjacent to each valve and at final connection to each specialty and piece of equipment.

3.02 INSTALLATION OF VALVES

- A. Provide shutoff valve at each connection to equipment and specialties.
- B. Provide check valves to maintain correct direction of gas flow from gas supplies.
- C. Provide pressure regulators on gas piping where reduced pressure is required.

3.03 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from outside of cleaned tubing and fittings before assembly.
- C. Brazed Joints: Join copper tube and fittings in accordance with CDA's "Copper Tube Handbook," Ch. "Braze Joints."
- D. Soldered Joints: Apply ASTM B813, water-flushable flux to tube end. Join copper tube and fittings in accordance with ASTM B828.

3.04 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for hangers, supports, and anchor devices specified in Section 230500.
- B. Vertical Piping: MSS Type 8 or Type 42, clamps.
- C. Individual, Straight, Horizontal Piping Runs: MSS Type 1, adjustable, steel, clevis hangers.
- D. Provide hangers for copper tubing with maximum horizontal spacing and minimum rod diameters to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- E. Support horizontal piping within 12 inches of each fitting and coupling.
- F. Support vertical runs of copper tubing to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.05 INSTALLATION OF COMPRESSED-AIR EQUIPMENT

- A. Equipment Mounting: Provide on cast-in-place concrete equipment base. Comply with requirements for equipment bases and foundations specified in Section 230500. Install equipment anchored to substrate.
- B. Install equipment level and plumb, parallel, and perpendicular to other building systems and components.
- C. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.
- D. Install equipment to allow right of way for piping installed at required slope.

- E. Connect wiring and ground equipment in accordance with Division 26. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

3.06 IDENTIFICATION

- A. Provide identifying labels and devices, comply with requirements in Section 230500.

3.07 PROTECTION

- A. Protect tubing from damage.
- B. Retain sealing plugs in tubing, fittings, and specialties until installation.

3.08 STARTUP SERVICE – COMPRESSED-AIR

- A. Perform startup service.
 - 1. Complete installation and startup checks in accordance with manufacturer's written instructions.
 - 2. Check for lubricating oil in lubricated-type equipment.
 - 3. Check belt drives for proper tension.
 - 4. Verify that air compressor inlet filters and piping are clear.
 - 5. Check for equipment vibration-control supports and flexible pipe connectors and verify that equipment is properly attached to substrate.
 - 6. Check safety valves for correct settings. Ensure that settings are higher than air compressor discharge pressure, but not higher than rating of system components.
 - 7. Drain receiver tanks.
 - 8. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 9. Test and adjust controls and safeties.
- B. Prepare written report documenting testing procedures and results.
- C. Adjust equipment to function smoothly and lubricate as recommended by manufacturer.
- D. Adjust control set points.

3.09 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust and operate the compressed air unit.

END OF SECTION

SECTION 23 05 00

COMMON WORK RESULTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. This section applies to Plumbing Division 22 & and HVAC Division 23 sections.
- C. Related Sections include the following:
 - 1. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 GENERAL

- A. Section 23 05 00 includes items common to all the division specification sections.
- B. Provide services, skilled and common labor, and all apparatus and materials required for the complete installation as shown and within the intent of the contract documents, field conditions, and code requirements.
- C. The intention of these Contract Documents is to call for finished work, fully tested and ready for operation. Any components or labor not mentioned in the Contract Documents but required for functioning systems shall be provided. Should there appear to be any discrepancies or questions of intent, the Contractor shall refer the matter to the Architect/Engineer for a decision before start of any related work.
- D. Consistency and Completeness: The contract documents are intended to include all components; however, the contract documents may not be perfect. Repetitive, common components (such as volume dampers, thermostats, condensate drains, trap primers, vent pipes, valves, etc.) are shown throughout. If a common component is missing in from the drawings, provide as similar per other areas. There will be no change orders for missing such components, the contractor shall provide consistent, complete, functioning systems.
- E. Should the Drawings or the Specifications disagree in themselves or with each other, the Contractor shall provide the better quality or greater quantity of work and/or materials unless otherwise directed by written addendum to the Contract Documents.
- F. Materials or work described in words, which so applied, have a well-known technical or trade meaning shall be held to refer to such recognized standards. Since the plans and specifications cover the dimensions and features of the work and do not set forth the analysis of the design, it is the duty of the Contractor fulfilling them to ascertain the true intent in any case where it is doubtful.

1.03 MANUFACTURERS INSTRUCTIONS

- A. Provide equipment and components to comply with manufacturer's written installation instructions and published drawings.
- B. Follow manufacturer's instructions for inspection, start-up, calibration, commissioning, and testing.

1.04 DEFINITIONS

- A. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- B. "Provide": Furnish and install, complete and ready for the intended use.
- C. "Shall": The word "shall" is used to indicate mandatory requirements strictly to be followed in order to conform to the standard and procedures and from which no deviation is permitted.
- D. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and attics.
- E. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- F. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- G. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- H. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- I. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

1.05 SUBMITTALS

- A. Provide in accordance with Division 1 of the specifications.
- B. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.

1.06 SUBSTITUTIONS

- A. Provide in accordance with Division 1 of the specifications.
- B. Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Engineer for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
2. Requested substitution does not require revisions to the Contract Documents.
3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of the Work and shall be acceptable to all contractors involved.
8. Equipment electrical characteristics different than scheduled may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified at no additional cost.
9. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
10. Requested substitution has been coordinated with other portions of the Work.
11. Requested substitution provides specified warranty.

1.07 QUALITY ASSURANCE

- A. Work, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of the local, state, and federal authorities. Such codes, when more restrictive, shall take precedence over these plans and specifications.
- B. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
- C. Installer Qualifications: Work shall be done by skilled mechanics shall have successfully completed an apprenticeship program or another craft training program.
- D. The Contractor shall hold a license to perform the work as issued by the local jurisdiction.

1.08 COORDINATION

- A. Coordinate use of project space and sequence of installation of work, which is indicated diagrammatically on drawings. Follow routings shown, as closely as practicable, with due allowance for available physical space; make runs parallel with lines of building. Utilize space efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- B. Coordinate use of project space and sequence of installation of work.
- C. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for installations. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- D. Coordinate requirements for access panels and doors for items requiring access that are concealed behind finished surfaces. Access panels shall be provided for any item requiring

inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced, maintained, or replaced.

1. Access panels and doors are specified in Division 8 and shall be provided by the trade responsible for the equipment that needs access.

1.09 TEST ADJUST AND BALANCE READINESS

- A. The Contractor shall provide and coordinate the services of qualified, responsible sub-contractors, suppliers and personnel as required to correct, repair, and/or replace deficient items or conditions found during this project, including the testing, adjusting, and balancing period.
- B. In order that systems may be properly tested, balanced, and adjusted as required herein by these Specifications, the Contractor shall operate the systems at his expense for the length of time necessary to properly verify their completion and readiness for TAB. Project Contract completion schedules shall allow for sufficient time to permit the completion of TAB services prior to Owner occupancy. The Contractor shall allow adequate time for the testing and balancing activities of the Owner provided services, during the construction period, and prior to Substantial Completion as defined in the Uniform General Conditions of this Construction Document.
- C. The Drawings and Specifications indicate adjustment devices for the purpose of adjustment to obtain optimum operating conditions, and it will be the responsibility of the Contractor to provide these devices in a manner that will leave them accessible and readily adjustable. Should any such device not be readily accessible, the Contractor shall provide access as requested by the TAB Firm. Also, any malfunction encountered by TAB personnel and reported to the Contractor shall be corrected by the Contractor immediately so that the balancing work can proceed with the minimum of delays.
- D. Complete operational readiness of the HVAC systems also requires that the following be accomplished:
 1. Distribution Systems:
 - a. Verify installation for conformity to design. Ducts shall be terminated and tested as required by the Specification.
 - b. Dampers shall be properly located and functional. Dampers shall have tight closure and open fully with smooth and free operation.
 - c. RGD'S and terminal devices shall be provided and secured in a fully open position.
 - d. Air handling systems and associated apparatus shall be sealed to eliminate uncontrolled bypass or leakage of air. Clean filters shall be in place, coils shall be clean with fins straightened, bearings properly greased, and the system shall be completely operational. The Contractor shall verify that systems are operating within the design pressure limits of the piping and ductwork.
 - e. Under normal operating conditions, check condensate drains for proper connections and functioning. Cooling coil drain pans have a positive slope to drain. Cooling coil condensate drain trap maintains an air seal.
 - f. Fans shall be operating and verified for freedom from vibration, proper fan rotation.
 - g.
 - h. Bearings shall be greased.
 - i. Terminal units shall be provided and functional (i.e., controls functioning).
 2. Water Circulating Systems:

- a. Verify installation for conformity to design. Hydronic systems are pressure tested, flushed, filled, and properly vented; valves are fully open. Examine HVAC system and equipment installations to verify that indicated balancing devices are properly provided, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation
 - b. Valves shall be set to their fully open position. After the system is flushed and checked for proper operation, strainers shall be removed and cleaned. The Contractor shall repeat the operation until circulating water is clean and then the start-up strainers shall be discarded.
 - c. Record motor amperage on each phase and voltage after reaching rated speed. Readings shall not exceed nameplate rating. Thermal overload protection is in place.
 - d. In preparation of TAB, water circulating systems shall be full and free of air, expansion tanks shall be set for proper water level, and air vents shall be provided at high points of systems and operating freely. Chemicals shall be added to closed systems to treat piping and inhibit corrosion. The system static pressure shall be adequate to completely fill the system without operating the pumps.
 - e. Check and set operating parameters of the heat transfer and control devices to the design requirements.
 - f. Proper balancing devices shall be in place and located correctly. Heat transfer coils shall be checked for correct piping connections.
3. Building Automation System (BAS)
- a. The BAS Contractor shall verify that control components are provided in accordance with project requirements and are functional.
 - b. The BAS Contractor shall verify that controlling instruments are calibrated and set for design operating conditions except for components that require input from the TAB Agency, but a default shall be set. The Control Contractor shall cooperate with the TAB Agency and provide software and interfaces to communicate with the system.
 - c. The BAS Contractor shall thoroughly check controls, sensors, operators, sequences, etc. before notifying the TAB Agency that the BAS is operational. The BAS Contractor shall provide technical support (technicians and necessary computers) to the TAB Agency for a complete check of these systems.
 - d. Prior to occupancy, each ventilation system shall be tested to ensure that OA dampers operate properly in accordance with system design.
 - e. Fire Alarm: Division 26 shall thoroughly check detection devices, sequences, interlocks, etc. before notifying the TAB Agency that the system is operational. Division 26 shall certify that the systems are totally operational to the Contractor prior to the TAB beginning.

1.10 RENOVATION PROJECT REQUIREMENTS

- A. The Contractor shall cooperate with the Owner to minimize conflicts with the Owner's operations.
- B. The Contractor shall study drawings and specifications, visit the site, and get acquainted with the existing conditions and the requirements of the plans and specifications. No claim will be recognized for extra compensation due to the failure of the Contractor to be familiarized with the conditions and extent of the proposed work. The Contractor shall execute alterations, additions, removals, relocations, or new work, etc., as indicated, or required to provide a complete installation in accordance with the intent of the drawing and specifications.

- C. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of site beyond areas in which the Work is indicated. Keep driveways and entrances serving premises clear and available to Owner. Schedule deliveries to minimize use of driveways and entrances and minimize space and time requirements for storage of materials and equipment on-site.
- D. Follow the recommended procedures of the SMACNA IAQ Guidelines for Occupied Buildings under Construction.
- E. Continuity of Services: The building will be in use during construction operations. Maintain existing systems in operation within rooms of building. Schedules for various phases of contract work shall be coordinated with other trades and with Owner's Representative. Provide, as part of the contract, temporary plumbing and mechanical and electrical connections and relocations as required to accomplish the above. 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. Notify Owner at least two days in advance of proposed utility interruptions. Identify extent and duration of utility interruptions. Indicate method of providing temporary utilities. Do not proceed with utility interruptions without Owner's written permission.
- F. Cutting And Patching: Provide temporary support of Work to be cut. 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. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
 - 1. Where existing services/systems are required to be removed relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
 - 2. Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay. 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.
 - 3. 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.
 - 4. Patch construction by filling, repairing, refinishing, closing, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing. Clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.
 - 5. Any structural member weakened or impaired by cutting, notching, or otherwise shall be reinforced, repaired, or replaced to be left in safe structural condition in accordance with the local building code requirements.
 - 6. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
 - 7. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

PART 2 - PRODUCT

2.01 PRODUCT CRITERIA

- A. Any costs incurred due to deviations from basis of design unit shall be responsibility of the contractor.
- B. Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 5 years.
- C. Equipment Service: Products shall be supported by a service organization that maintains a complete inventory of repair parts and is located reasonably close to the site.
- D. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
- E. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
- F. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.
- G. Asbestos products or equipment or materials containing asbestos shall not be used.

2.02 PROGRAMMABLE 3-PHASE LINE VOLTAGE MONITORS

- A. Provide for all inverter-driven equipment.
- B. Provide an ICM Controls Model #ICM450A or equal, for motor protection from premature failure and damage caused by common voltage faults such as phase unbalance, over/under voltage, phase loss and phase reversal.
 - 1. Voltage: Universal, 190-600 VAC
 - 2. Simultaneous 3-phase true RMS voltage monitoring
 - 3. Factory calibrated.
 - 4. 3-phase voltages simultaneously displayed on LCD
 - 5. Fault memory
 - 6. Fault monitoring: High / low voltage, voltage unbalance, phase loss, phase reversal
 - 7. Simple configuration
 - 8. Fully adjustable variables
 - 9. Modbus RS485 communications
 - 10. LED indicators
 - 11. Common 1/4" quick connect terminations.

2.03 IDENTIFICATION

- A. Equipment:
 - 1. Terminology: Match schedules as closely as possible.
 - 2. Stencils for Access Panels and Door Labels, Equipment Labels, and Similar Operational Instructions:

- a. Lettering Size: Minimum letter height of 1/2 inch for viewing distances of up to 72 inches and proportionately larger lettering for greater viewing distances.
 - b. Stencil Material: Fiberboard or metal.
 - c. Paint: Exterior, alkyd enamel. Paint may be in pressurized spray-can form.
- B. In addition to the equipment tag, equipment located above the ceiling that requires servicing shall be labeled on the ceiling grid using a labeling machine.
- C. Piping Identification Devices
 1. Manufactured Pipe Markers, General: Seton, Brady, or approved equal; preprinted, color-coded, with lettering indicating service, and showing direction of flow.
 2. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length. Size of letters and length of color field per ASME A13.1.
 3. Pipes with OD, Including Insulation; Full-band snap-around pipe markers extending 360 degrees around pipe at each location. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow. Length of color field and size of letters shall be proportional to pipe OD.
 4. Types: Self-adhesive type: Seton Opti-Code; Snap-around type: Seton Setmark; Wrap-around type: Seton Ultra-mark; PVF over-laminated polyester construction seals in and protects graphics; suitable for outdoor or harsh environments.
- D. Duct Markers:
 1. Pre-printed, color-coded, with lettering indicating associated equipment, service, and showing flow direction. Include identification of duct service using same system designation as used on Drawings and an arrow indicating flow direction. On each label, prefix the system designation with the associated equipment number (example: AHU-1 SUPPLY AIR).
 2. Material: MS900 vinyl with pressure sensitive acrylic adhesive backing. Marker Size: 2-1/4 inch high, with length to suit required label content. Lettering Size: Minimum 1-1/2 inches high. Direction-of-Flow Arrows: Separate unit for each duct label to indicate flow direction. Arrow Marker Size: 2-1/4 inch by 6-1/2 inches
- E. Concealed manual volume dampers shall be visible outside the insulation and marked with 12" orange ribbon.
- F. Valve Tags & Schedules
 1. Valve Tags: Stamped or engraved 1-1/2 round with 1/4-inch letters for piping system legend and 1/2-inch black-filled numbers, with numbering scheme; 3/16" hole for fastener; Material: 19-gauge brass; Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook.
 2. Valve Schedules: For each piping system, on standard-size bond paper. Also save in PDF format. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws. Frame: aluminum. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

- G. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing. Size: 3 by 5-1/4 inches minimum. Large-size primary caption such as "DANGER". Color: Yellow background with black lettering.

2.04 PIPE JOINING MATERIALS

- A. Provide per local code.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.
- C. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Press Connections
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Viega LLC; ProPress, Apollo, or approved equal.
 - 2. Press ends shall have Viega Smart Connect, Apollo Leak Before Press, or similar technology designed into the fitting itself, allowing identification of an un-pressed fitting during pressure testing. The function of this feature is to provide the installer quick and easy identification of connections which have not been pressed prior to putting the system into operation.
 - 3. Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of ASME B16.51 and IAPMO PS 117. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed, or an alternative supplied by the fitting manufacturer.
 - 4. Steel: Cold Press Mechanical Joint Fitting shall conform to material requirements of ASTM A420 or ASME B16.3 and performance criteria ANSI/CSA LC4. Sealing elements for press fittings shall be HNBR. Sealing elements shall be factory installed, or an alternative supplied by the fitting manufacturer. Piping and fittings shall comply with CSA LC-4 and local codes.
- E. Mechanical Coupling Gasket Materials: Suitable for the chemical and thermal conditions of the piping system contents and exterior environment. Gasket design shall be such that the entire coupling housing is isolated from the system contents to prevent galvanic action and inhibit galvanic corrosion.
- F. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- G. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- H. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- I. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

- J. Solvent Cements for Joining Plastic Piping: CPVC Piping: ASTM F 493. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
- K. Plastic-to-Metal Transition Fittings: one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657. Plain-End Pipe and Fittings: Use butt fusion. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Provide dielectric isolation at the connection of dissimilar metals. Provide brass ball valves or fittings; or Watts Series LF3000 (lead free) or approved equal.

2.05 SLEEVES & ESCUTCHEONS

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral water-stop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- F. Provide penetration system where service pipes penetrate through foundation wall or floor. Make installation watertight. Mechanical Sleeve Seals: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve; Thunderline Link-Seal, Advanced Product & Systems, LLC, Garlock, or approved equal.
 - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Glass-reinforced nylon.
 - 3. Connecting Bolts and Nuts: Stainless steel, of length required to secure pressure plates to sealing elements.
- G. Escutcheons shall be manufactured from nonferrous metals and shall be chrome-plated. Metals and finish shall conform to ASME A112.19.2. Escutcheons shall be one-piece type where mounted on chrome-plated pipe or tubing, and one-piece of split-pattern type elsewhere. ID shall closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers the opening. Escutcheons shall have setscrews for maintaining a fixed position against a surface.

2.06 ROOF PIPING

- A. Roof Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping. Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration. Bases: One or

more; plastic. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

- B. Roof Pipe Penetrations: Thybar TCC-3 curb system with cover and pipe boots.
 - 1. Prefabricated roof curb to be manufactured of prime galvanized steel construction, 20, 18, 16 or 14 gauge as required, meeting ASTM A653/653M, with welded corners and with seams joined by continuous welds. Roof curb shall be internally reinforced with angles 48" on center, factory insulated with 1-½" thick 3# density fiberglass insulation, and factory installed wood nailers. Height to be 18" above roof deck or as detailed. Top of all roof curbs shall be level, with pitch built into curb when deck slopes.
 - 2. ABS Thermoplastic cover on top of curb.
 - 3. Graduated Boots Molded or Weather-Resistant Plastisol
 - 4. SS pipe clamps, 2 per boot.

2.07 HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. B-Line Systems, Inc.
 - 2. Carpenter & Patterson, Inc.
 - 3. Grinnell Corp.
 - 4. Hubbard Enterprises/Holdrite
 - 5. National Pipe Hanger Corp.
 - 6. Piping Technology & Products, Inc.
 - 7. Unistrut
 - 8. Anvil International, Inc.
 - 9. Empire
- B. Provide in accordance with MSS SP69 - Manufacturers Standardization Society: Pipe Hangers and Supports- Selection and Application. Steel pipe hangers and supports shall have the manufacturer's name, part number, and applicable size stamped on the part itself for identification.
- C. The materials of pipe hanging and supporting elements shall be in accordance with MSS SP-58. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications." Do not allow dissimilar metals to come into contact.
- D. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel." Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications." Comply with provisions in ASME B31 Series, "Code for Pressure Piping." Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- E. Delegated-Design Submittal: For hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Show fabrication and installation details and include calculations. Provide for the following: trapeze pipe hangers, metal framing systems, pipe stands, equipment supports.

F. Hangers:

1. Uninsulated pipes 2 inch and smaller: Adjustable steel swivel ring (band type) hanger, Type 10, B-Line B3170; Adjustable steel swivel J-hanger, Type 5, B-Line B3690; Malleable iron ring hanger, Type 12, B-Line B3198R or hinged ring hanger, B3198H. Adjustable steel clevis hanger, Type 1, B-Line B3100.
2. Uninsulated pipes 2-1/2 inch and larger: Adjustable steel clevis hanger, Type 1, B-Line B3100.
3. Insulated Hot piping: 2 inch and smaller pipes: use adjustable steel clevis with galvanized sheet metal shield. Type 1, B-Line B3100 with Type 40, B-Line B3151 series insulation protection shield. 2-1/2 inch and larger pipes: Type 41 or Type 43 with Type 39A/39B, B3160-B3165 series pipe covering protection saddle.
4. Insulated Cold piping: use adjustable steel clevis with galvanized sheet metal shield. Type 1, B-Line B3100 with Type 40, B-Line B3151 series insulation protection shield.
5. Copper Tubing Supports Hangers shall be sized to fit copper tubing outside diameters. Adjustable steel swivel ring (band type) hanger, Type 10, B-Line B3170CT. Malleable iron ring hanger, Type 12, B-Line B3198RCT or hinged ring hanger B3198HCT. Adjustable steel clevis hanger, Type 1, B-Line B3104CT. For supporting copper tube to strut use plastic inserted vibration isolation clamps, B-Line BVT series.
6. Plastic Pipe Supports: V-Bottom clevis hanger with galvanized 18-gauge continuous support channel, Type 1, B-Line B3106 and B3106V plastic pipe support channel, to form a continuous support system for plastic pipe or flexible tubing.

G. Pipe Clamps: When flexibility in the hanger assembly is required due to horizontal movement, use pipe clamps with weldless eye nuts, Type 4, B-Line B3140. For insulated lines use double bolted pipe clamps, Type 3, B-Line B3144.

H. Multiple or Trapeze Hanger: Trapeze hangers shall be constructed from 12-gauge roll formed ASTM A1011 SS Grade 33 structural steel channel, 1-5/8 inch by 1-5/8-inch minimum, B-Line B22 strut or stronger as required. Mount pipes to trapeze with 2-piece pipe straps sized for outside diameter of pipe, B-Line B2000 Series.

I. Wall Supports: Pipes 4" and smaller: Carbon steel J-hanger, B-Line B3690. Pipes larger than 4": Welded strut bracket and pipe straps, Type 31 light welded steel bracket, B-Line B3064. Provide Type 32 or Type 33 for heavier loads.

J. Floor Supports: Hot piping under 6 inch and cold piping: Carbon steel adjustable pipe saddle and nipple attached to steel base stand sized for pipe elevation. Type 38 adjustable pipe saddle, B-Line B3093 and B3088T base stand; or Type 39, B3090 and B3088 base stand. Pipe saddle shall be screwed or welded to appropriate base stand. Hot piping 6 inch and larger: Adjustable Roller stand with base plate, Type 46, B3118SL. Adjustable roller support and steel support sized for elevation, B-Line B3124.

K. Vertical Supports: Steel riser clamp sized to fit OD of pipe, Type 8, B-Line B3373.

L. Supplementary Structural Supports: Design and fabricate supports using structural quality steel bolted framing materials as manufactured by Cooper B-Line. Channels shall be roll formed, 12-gauge ASTM A1011 SS Grade 33 steel, 1-5/8 inch by 1-5/8 inch or greater as required by loading conditions. Submit designs for pipe tunnels, pipe galleries, etc., to engineer for approval. Use clamps and fittings designed for use with the strut system.

M. Beam Clamps shall be used where piping is to be suspended from building steel. Clamp type shall be selected based on load to be supported, and load configuration. C-Clamps shall have locknuts and cup point set screws, Type 23, B-Line B351L. Refer to manufacturer's recommendation for setscrew torque. Retaining straps shall be used to maintain the clamps position on the beam where required.

- N. Concrete Inserts: Cast in place spot concrete inserts shall be used where applicable; either steel or malleable iron body, Type 18, B-Line B2500 or B3014. Spot inserts shall allow for lateral adjustment and have means for attachment to forms. Select inserts to suit threaded hanger rod sizes, B-Line N2500 or B3014N series. Continuous concrete inserts shall be used where applicable. Channels shall be 12 gauge, ASTM A1011 SS Grade 33 structural quality carbon steel, complete with Styrofoam inserts and end caps with nail holes for attachment to forms. The continuous concrete insert shall have a load rating of 2,000 lbs./ft. in concrete, B-Line B221, 321, or 521. Select channel nuts suitable for strut and rod sizes.
- O. For air conditioning and other vibrating system applications, use a clamp that has a vibration dampening insert and a nylon inserted locknut. For copper and steel tubing use B-Line BVT-Series Vibraclamps. For larger tubing or piping subjected to vibration, use neoprene or spring hangers as required. For base mounted equipment use vibration pads, molded neoprene mounts, or spring mounts as required.
- P. Accessories
1. Hanger Rods shall be threaded both ends or continuous threaded rods of circular cross section. Use adjusting locknuts at upper attachments and hangers. No wire, chain, or perforated straps are allowed.
 2. Shields shall be 180-degree galvanized sheet metal, 12-inch minimum length, 18-gauge minimum thickness, designed to match outside diameter of the insulated pipe, B-Line B3151.
 3. Pipe protection saddles shall be formed from carbon steel, 1/8-inch minimum thickness, sized for insulation thickness. Saddles for pipe sizes greater than 12 inch shall have a center support rib.
- Q. Indoor Finishes: Hangers and clamps for support of bare copper piping shall be coated with copper colored epoxy paint, B-Line Dura-Copper®. Additional PVC coating of the epoxy painted hanger shall be used where necessary. Hangers for other than bare copper pipe shall be zinc plated in accordance with ASTM B633; or shall have an electro-deposited green epoxy finish, B-Line Dura-Green®. Strut channels shall be pre-galvanized in accordance with ASTM A653 SS Grade 33 G90 OR have an electro-deposited green epoxy finish, B-Line Dura-Green®.
- R. Outdoor Finishes: Hangers and strut located outdoors shall be hot dip galvanized after fabrication in accordance with ASTM A123. Hanger hardware shall be hot dip galvanized or stainless steel. Zinc plated hardware is not acceptable for outdoor or corrosive use.
- S. Unistrut (MFMA) Manufacturer Metal Framing System:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Unistrut Corporation
 - b. Cooper B-Line, Inc.
 - c. Flex-Strut Inc.
 - d. Thomas & Betts Corporation.
 2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes. Standard: MFMA-4.
 3. Channels: Continuous slotted steel channel with in-turned lips. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

4. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
5. Coating: Unistrut Perma-green or similar.

2.08 THERMOMETERS AND PRESSURE GAUGES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Ashcroft
 2. Weksler
 3. Ernst Gauge Co.
 4. Trerice: H. O. Trerice Co.
 5. Weiss Instruments, Inc.
- B. The proper range will be selected so that the operating temperature/pressure of the material being measured will fall approximately in the middle of the scale.
- C. Liquid-In-Glass Industrial Thermometers: shall be a blue reading (Fill Type Spirit: Blue colored, organic) liquid-in-glass adjustable angle type, 9" scale, cast aluminum case with cured polyester powder coating, clear acrylic window and brass separable thermowell. Thermometers will be Trerice BX9 Series or approved equal.
- D. Thermowells: Provide fitting with protective socket for installation in threaded pipe fitting to hold fixed thermometer stem. Material shall be compatible with the piping. Where insulation thickness exceeds 2", a longer stem thermometer will be used with an extension neck brass separable thermowell. The extension neck will be at least 2" long. Cap: Threaded, with chain permanently fastened to socket.
- E. Pressure gauges shall be 3½" dial size with a flangeless cast aluminum case, stainless steel friction ring and glass window. The movement will be brass with a bronze bourdon tube and brass socket. The dial face will be white with black figures; pointer will be friction adjustable type. Accuracy shall be ±1% of scale range, ASME B40.1 Grade 1A. Pressure gauges will be Trerice No. 600CB approved equal.
 1. Connector: Brass, NPT 1/4.
 2. Units of Measure: PSI
 3. Provide silicone-damped movement.
 4. Provide pressure-gauge needle valve and snubber (Trerice No. 872 pressure snubbers) in piping to pressure gauges; ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant porous-metal disc of material suitable for system fluid and working pressure.
 5. Needle Valves: Trerice 735 Series; NPS 1/4 brass or 316 stainless steel needle type.

2.09 MISCELLANEOUS

- A. Grout: ASTM C 1107, Grade B, non-shrink, and nonmetallic, dry hydraulic-cement grout. Characteristics: Post-hardening, volume adjusting, non-staining, non-corrosive, nongaseous, and recommended for interior and exterior applications. Design Mix: 5000-psi, 28-day compressive strength. Packaging: Premixed and factory packaged.
- B. Equipment shall be vibration isolated to prevent vibration transmission to the building structure.

PART 3 - EXECUTION

3.01 DEMOLITION AND REMOVALS

- A. Refer to Division 1 for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove plumbing and mechanical systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and cap and seal remaining ducts with same or compatible ductwork material.
 - 4. Ducts to Be Abandoned in Place: Cap and seal ducts with same or compatible ductwork material.
 - 5. Equipment to be Removed: Disconnect and cap services and remove equipment.
 - 6. Equipment to be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.02 COMMON REQUIREMENTS

- A. Work shall be conducted, installed, and completed in a neat and professional manner reflecting a minimum level of competent workmanship.
- B. The drawings show the general arrangement of systems and equipment but do not show all required fittings and offsets that may be necessary to connect pipes and ductwork to equipment, and to coordinate with other trades. Provide necessary fittings, offsets and runs based on field measurements and at no additional cost. Coordinate with other trades for space available and relative location of equipment and accessories. Pipe and duct location on the drawings shall be altered by the contractor where necessary to avoid interferences and clearance difficulties.
- C. Fabricate based on field measurements.
- D. Corrections or comments made on the shop or coordination drawings during the review do not relieve Contractor from compliance with requirements of the drawings and specifications. The Contractor is responsible for: confirming and correcting quantities; checking electrical characteristics and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of other trades; and performing work in a safe and satisfactory manner.
- E. Protection and Cleaning: Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations. Damaged or defective items shall be replaced. Protect finished parts of equipment. Close duct and pipe openings with caps or plugs during installation.

Tightly cover and protect fixtures and equipment against dirt, water, chemical, or mechanical injury. At completion of work thoroughly clean fixtures, exposed materials, and equipment.

- F. Provide piping, ductwork, and equipment to allow maximum headroom unless specific mounting heights are indicated. Provide equipment level and plumb, parallel, and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- G. Provide equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- H. Coordinate location of piping, ductwork, sleeves, inserts, hangers, and equipment. Locate to clear other construction, services, and utilities.
- I. Provide piping and ductwork in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- J. Provide systems above accessible ceilings to allow sufficient space for ceiling panel removal.
- K. Verify final equipment locations for roughing-in.
- L. Do not enclose, cover, or put into operation until inspected and approved by authorities having jurisdiction.
- M. The contract documents indicate required valves, fittings, and accessories. If additional materials are required by code or manufacturer's instructions, they shall be provided at no cost to the owner.

3.03 PIPING INSTALLATIONS

- A. Provide 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.
 - 1. Provide piping to permit valve servicing.
 - 2. Provide equipment and other components to allow right of way for piping installed at required slope.
 - 3. Provide free of sags and bends.
 - 4. Provide unions or flanges at connections to equipment.
 - 5. Provide fittings for changes in direction and branch connections.
 - 6. Make allowances for application of insulation.
- B. Provide piping adjacent to equipment and machines to allow service and maintenance.
- C. Use transition fitting to join dissimilar piping materials. Connect piping in sizes indicated, but not smaller than sizes of unit connections.
- D. Select system components with pressure rating equal to or greater than system operating pressure.
- E. Plastic piping: Piping shall be installed to avoid damage from adjacent light fixtures. In certain construction situations, these plastic pipes may be installed near recessed light fixtures in ceilings. Light fixtures may have exterior temperatures as high as 194°F.

- F. Plumbing: General layout shown, provide piping and components as required by the local plumbing code. A licensed master plumber shall perform or supervise the work and provide layouts, piping, and fittings as required by code.

3.04 PIPING JOINT CONSTRUCTION

- A. Pipe and tube required by the applicable standard to be cleaned and capped shall be delivered to the job site with factory-applied endcaps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture. Protect stored pipe and tube from moisture and dirt. Elevate above grade. When stored inside, do not exceed the structural capacity of the floor. Protect fittings, flanges, and piping specialties from moisture and dirt. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.
- B. Joints shall be fabricated, joined, and tested per the piping and fitting manufacturer's instructions. Joint preparation, setting and alignment, joining process, timing, hanger spacing, and working pressure shall be in accordance with the pipe and fitting manufacturer's specifications.
- C. Join pipe and fittings according to the following requirements and the relevant specification section specifying piping systems.
- D. Ream ends of pipes and tubes and remove burrs. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- E. Installer Qualifications
 - 1. Pipe fitters shall be qualified in the procedure used to perform the pipe joining.
 - 2. The contractor is responsible for documenting the qualification and training records of each pipe fitter. Pipe fitters shall have current, formal training on the pipe jointing method.
 - 3. Contractor must submit documentation that lists personnel assigned to this project prior to beginning construction who have successfully completed formal training conducted by an authorized manufacturer's representative. The Contractor Training documentation shall be specific to the manufacturer of the pipe and fittings.
 - 4. Personnel's training documentation must be current and have been updated within the past two (2) years. Training received more than two years prior to operation with no evidence of activity within the past 6 months shall not be considered current.
 - 5. Piping Warranty: Contractor shall provide, and document required training and required by the piping system manufacturer to maintain the piping manufacturer's warranty.
- F. Provide dielectric isolation at the connection of the dissimilar piping (copper and steel).
- G. 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.
- H. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.
- I. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.

4. Apply appropriate tape or thread compound to external pipe threads unless dry-seal threading is specified.
 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- J. Press connections:
1. The joints shall be pressed using the tools approved by the manufacturer.
 2. Always examine the pipe to ensure it is fully inserted into the fitting prior to pressing the joint.
 3. Pipe ends shall be cut on a right angle (square) to the pipe.
 4. Copper: The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tools approved by the manufacturer.
 5. Steel: Pipe ends shall be reamed chamfered, and paint, lacquer, grease, oil, or dirt shall be removed from the pipe end with an abrasive cloth, or with the Rigid MegaPress pipe end prep tool. Sealing elements shall be verified for the intended use. Visually examine the fitting sealing element to ensure there is no damage. Utilizing a Viega insertion depth inspection gauge mark the tube wall, with a felt tip pen, at the appropriate location, or insert the pipe fully into the fitting and mark the pipe wall at the face of the fitting.
- K. PEX Joints: Provide per manufacturer's recommendations. Use manufacturer-recommended cold-expansion tool for F1960 connections.
- L. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators. Bevel plain ends of steel pipe. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- M. Flanged Joints: Provide appropriate gasket material, size, type, and thickness for service application. Provide gasket concentrically positioned. Use suitable lubricants on bolt threads.
- N. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix. PVC Piping: Join according to ASTM D 2855.

3.05 PIPE PENETRATIONS, SLEEVES, & ESCUTCHEONS

- A. Pipe penetrations shall be sealed, provide sealants for pipe penetrations
- B. Provide allowance for thermal expansion and contraction of copper tubing passing through a wall, floor, ceiling, or partition by wrapping with an approved tape or pipe insulation or by installing through an appropriately sized sleeve.
- C. Sleeve Clearance: Sleeve through floors, walls, partitions, and beams shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation.
- D. Provide sleeves for pipes passing through concrete and masonry construction. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint. Cut sleeves to length for mounting flush with both surfaces. Provide sleeves in new walls and slabs as new walls and slabs are constructed. Provide steel pipe sleeves that are large enough

to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Piping through concrete or masonry shall not be subject to any load from the building construction.

1. Sleeves are not required in drywall construction.
 2. Sleeves are not required for core-drilled holes. Provide core drilling as required.
- E. To prevent accidental liquid spills from passing to a lower level, provide the following:
1. For sleeves: Extend sleeve 1-1/2 inch above finished floor and provide sealant for watertight joint.
 2. For blocked out floor openings: Provide 1-1/2-inch angle set in silicone adhesive around opening.
 3. For drilled penetrations: Provide 1-1/2-inch angle ring or square set in silicone adhesive around penetration.
- F. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 7.
- G. Exterior- Pipe Penetrations: Provide sleeve-seal systems in sleeves at service piping entries into building. 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 provide in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.
- H. Escutcheons:
1. Provide escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork.
 2. Provide escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 3. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.
- I. Plastic and copper piping penetrating framing members, and within one-inch of the framing, shall be protected with 10-gauge steel nailing plates. The steel plate shall extend along the framing member a minimum of 1.5" beyond the OD of the pipe or tubing.

3.06 PIPE HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Provide hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or provide intermediate supports for smaller diameter pipes as specified for individual pipe hangers. 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. Metal Framing System Installation: Provide per manufactures recommendations and calculations.

- D. Thermal-Hanger Shield Installation: Provide in pipe hanger or shield for insulated piping.
- E. Fastener System Installation: Provide 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. Provide fasteners according to powder-actuated tool manufacturer's operating manual. Provide mechanical-expansion anchors in concrete after concrete is placed and completely cured. Provide fasteners according to manufacturer's written instructions.
- F. Provide hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Provide hangers and supports to allow controlled thermal or seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Provide lateral bracing with pipe hangers and supports to prevent swaying.
- J. Provide building attachments within concrete slabs or attach to structural steel. Provide additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Provide concrete inserts before concrete is placed; fasten inserts to forms and provide reinforcing bars through openings at top of inserts.
- K. Provide for expansion and contraction of the piping system. Since changes in direction in the system are usually sufficient to allow for expansion and contraction, hangers must be placed so as not to restrict this movement
- L. Pipe Slopes: Provide hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by plumbing code and ASME B31.9 for building services piping. Piping shall be supported in such a manner as to maintain its alignment and prevent sagging.
- M. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.
- N. Insulated Piping: Attach clamps and spacers to piping.
 - 1. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - 2. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
- O. Equipment Supports: Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor. Grouting: Place grout under supports for equipment and make bearing surface smooth. Provide lateral bracing, to prevent swaying, for equipment supports.
- P. Metal Fabrications: Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations. 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. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. Finish welds at exposed

connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

- Q. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

R. Hanger and Support Schedule

1. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
2. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
3. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

S. Hanger Spacing

1. Support piping and tubing not listed below according to MSS SP-69 and manufacturer's written instructions.
2. Load Distribution: Provide hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment. Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading.
3. Space and provide hangers with the fewest practical rigid anchor points.
4. Piping shall be supported at intervals sufficiently close to maintain correct pipe alignment and to prevent sagging or grade reversal.
5. Pipe shall be supported at branch ends and at changes of direction.
6. Provide hangers for steel piping with the following maximum horizontal spacing and minimum rod sizes:
 - a. NPS 3/4 to 1: Maximum span, 6 feet; minimum rod size, 3/8 inch.
 - b. NPS 1-1/4: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 - c. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
 - d. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
 - e. NPS 2-1/2 to 3: Maximum span, 10 feet; minimum rod size, 1/2 inch.
 - f. NPS 4 to 5: Maximum span, 10 feet; minimum rod size, 5/8 inch.
 - g. NPS 6 to 8: Maximum span, 10 feet; minimum rod size, 3/4 inch.
7. Provide hangers for copper piping with the following maximum horizontal spacing and minimum rod sizes:
 - a. NPS 1/2 and 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
 - b. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
 - c. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
 - d. NPS 1-1/2 to 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 - e. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
 - f. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
 - g. Maximum vertical steel and copper pipe attachment spacing: 10 feet.
8. Provide hangers for cast-iron piping with the following maximum horizontal spacing and minimum rod diameters:
 - a. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - b. NPS 3: 60 inches with 1/2-inch rod.

- c. NPS 4 to 5: 60 inches with 5/8-inch rod.
 - d. NPS 6 to 8: 60 inches with 3/4-inch rod.
 - e. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
 - 9. Piping Hangers for Plastic Piping:
 - a. Hangers shall not compress, distort, cut, or abrade the piping.
 - b. Hangers shall be placed next to the pipe joint not more than 18" from the point joint.
 - c. Maximum horizontal spacing and minimum rod diameters (pipe temperature 100°F or lower).
 - d. Solvent cemented PVC
 - 1) NPS 2 and smaller: 48" with 3/8-inch rod.
 - 2) NPS 2-1/2: 48" with 1/2-inch rod.
 - 3) NPS 3: 48" with 1/2-inch rod.
 - 4) NPS 4: 48" with 5/8-inch rod.
 - 5) NPS 6: 48" with 3/4-inch rod.
 - 10. Provide supports for vertical piping every 10 feet.
- T. PEX Piping
- 1. Horizontal PEX-a Piping Hangers: Provide CTS hangers suitable for PEX-a piping in compliance with the manufacturer's instructions and local codes, with the following maximum spacing:
 - a. For UPC Jurisdictions: 1 inch and below: Maximum span, 32 inches.
 - b. For UPC Jurisdictions: 1-1/4 inch and above: Maximum span, 48 inches.
 - c. Note: The above maximum hanger spacing requirements may be extended with the use of a continuous support channel such as Uponor PEX-a Pipe Support.
 - 2. Horizontal PEX-a Piping with PEX-a Pipe Channel: Provide hangers for PEX-a piping with horizontal support channel in accordance with local jurisdiction and manufacturer's recommendations, with the following maximum spacing:
 - a. 3/4 inch and below: Maximum span, 6 feet.
 - b. 1 inch and above: Maximum span, 8 feet.
 - 3. Vertical PEX-a Piping: Support PEX-a piping with maximum spacing of 5 feet.
 - 4. PEX-a Riser Supports: Provide CTS riser clamps at the base of each floor and at the top of every other floor for domestic hot-water systems. Provide mid-story guides between each floor. Provide CTS riser clamps at the base of each floor and at the top of every fourth floor for domestic cold-water systems. Provide mid-story guides.
- U. Support vertical piping independently of connected horizontal piping. Support vertical pipes at base and at every floor. Wherever possible, locate riser clamps directly below pipe couplings or shear lugs.
- V. Place a hanger within 12 inches of each horizontal elbow.
- W. Horizontal pipe isolation:
- 1. The first four pipe hangers in the main lines near mechanical equipment shall be Mason Type PC30N or approved equal. Brace hanger rods with SRC clamps.

2. Floor supported piping shall rest on Type SLR isolators.
3. Hanger locations that also have seismic restraints attached must have type RW Rebound Washers to limit uplift.
4. Where piping connects to mechanical equipment provide expansion joints stainless hoses if expansion joints are not suitable for the service.
5. Adjust active height of spring isolators. Adjust isolators after piping systems have been filled and equipment is at operating weight. 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.

3.07 VALVE INSTALLATION

- A. Valves shall be installed in accordance with the manufacturer's recommendations.
- B. Provide valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown. Locate valves for easy access and provide separate support where necessary.
- C. Provide valves in horizontal piping with stem at or above center of pipe.
- D. Provide valves in position to allow full stem movement.
- E. Provide strainers on supply side of each control valve and elsewhere as indicated or recommended by component manufacturer to have strainer protection. Provide valved drain and hose connection on strainer blow down connection.
 1. Provide with provisions for service clearance.
 2. Remove and clean strainer after 24 hours of operation and after 30 days of operation.
- F. Control valves shall be installed so that they are accessible and serviceable and so that actuators may be serviced and removed without interference from structure or other pipes and/or equipment.
- G. Isolation valves shall be installed so that the control valve body may be serviced without draining the supply/return side piping system. Unions shall be installed at connections to screw-type control valves.
- H. Provide check valves at each pump discharge and elsewhere as required to control flow direction.
- I. Provide hose end drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

3.08 IDENTIFICATION

- A. Provide equipment markers on each item of scheduled equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated. Locate markers where accessible and visible. Equipment located above the ceiling that requires servicing shall be labeled on the ceiling using a labeling machine.
 1. Letters shall be 1/4" high, black.
 2. Label equipment above ceiling that requires servicing or access. Locate labels on the ceiling grid, adjacent to the ceiling tile that provides the best access to the valve or item that requires servicing.

B. Piping Identification:

1. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; mechanical rooms; accessible maintenance spaces such as shafts and plenums; and exterior exposed locations as follows:
 - a. Near each valve and control device.
 - b. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - c. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
 - d. At access doors and similar access points that permit view of concealed piping.
 - e. Near major equipment items and other points of origination and termination.
 - f. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - g. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
2. Directional Flow Arrows: Arrows shall be provided to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
3. Apply "Electric Traced" labels to the outside of heat-traced insulation.

C. Duct Identification: Locate duct markers at ducts leaving mechanical rooms and at riser shaft branches. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

D. Provide tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule. Mount valve schedule on wall in accessible location in each major equipment room. Provide (2) copies of valve schedules in digital format.

E. Relocate mechanical identification materials and devices that have become visually blocked by other work. Clean faces of mechanical identification devices.

3.09 THERMOMETERS AND PRESSURE GAUGES

- A. Provide thermometers and adjust vertical and tilted positions. Provide thermowells with extension on insulated piping. Provide separable sockets in vertical position in piping tees.
- B. Provide pressure gauges in piping tees with pressure-gauge valve located on pipe at most readable position. Provide valve and snubber in piping for each pressure gage for fluids.
- C. Calibrate according to manufacturer's written instructions, after installation.
- D. Adjust faces to proper angle for best visibility. Clean windows and clean factory-finished surfaces. Replace cracked and broken windows, and repair scratched and marred surfaces with manufacturer's touchup paint.

3.10 ERECTION OF SUPPORTS AND ANCHORAGES

- A. Fasten wall-hanging items securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated. Fasten recessed-type items to reinforcement built into walls.
- B. Wood: Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor materials and equipment. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Provide fasteners without splitting wood members. Attach to substrates as required to support applied loads.
- C. Metal: Provide in accordance with Division 5. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor materials and equipment. Field Welding: Comply with AWS D1.1.
- D. Grouting: Provide per manufacturer's instructions. Mix and provide grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors. Clean surfaces that will encounter grout. Provide forms as required for placement of grout. Avoid air entrapment during placement of grout. Place grout, completely filling equipment bases. Place grout on concrete bases and provide smooth bearing surface for equipment. Place grout around anchors. Cure placed grout.

3.11 FIRESTOPPING

- A. Fire-Barrier Penetrations: Coordinate penetrations/sleeve selection and application with selection and application of firestopping by others, specified in Division 07.

3.12 PAINTING

- A. Painting of plumbing and mechanical systems, equipment, and components is specified in Division 9.
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.13 CONCRETE HOUSEKEEPING PADS

- A. Concrete pads shall be provided by Division 22 & 23.
- B. Coordinate size, thickness, doweling, and reinforcing of concrete equipment housekeeping pads and piers with equipment manufacturer to ensure adequate space, embedment and prevent edge breakout failures.
- C. Construct concrete bases not less than 4 inches larger in both directions than supported unit.
- D. Housekeeping Pads must be adequately reinforced and adequately sized for proper installation of equipment anchors. Refer to seismic restraint manufacturer's written instructions.

E. Provide 4" high (+/-) housekeeping pads for the following:

1. Air compressor
2. Other base-mounted equipment.
3. As noted on plans
4. As recommended by Equipment manufacturer.

3.14 ROOFING

- A. Refer to Division 7.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.
- C. Roof Pipe Stand Installation: Provide per manufactures recommendations and calculations. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount them on a smooth roof surface. Do not penetrate roof membrane. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb.
- D. Roof Pipe Penetrations: Provide curb system with cover and pipe boots.
- E. Do not locate mechanical equipment within 10-feet of the roof edge.
- F. Roof Edge Fall Protection: Basis of Design: Keegard "Rooftop Guardrail for Narrow Spaces", or equal. Provide freestanding/non-penetrating roof edge protection system, including pipe railings, uprights, bases, counterweights, and fittings. Freestanding counterweighted guardrail system with 42 inches minimum height to provide a pedestrian egress barrier on the roof to withstand a minimum load of 200 lb. in any direction to the top rail per OSHA Regulation 29 CFR 1910.23. Pipe: Steel, 1-1/2 inches schedule 40, galvanized, galvanized or stainless-steel construction. Provide galvanized steel bases are galvanized with a rubber pad on underside of the component (set on roof, without disturbing existing adhered roof membrane).

3.15 PROJECT CLOSEOUT

- A. Starting and Adjusting
1. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace them with new units, and retest.
 2. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
 3. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 4. Provide commissioning per manufacturer's instructions. This start-up shall include verification of proper installation, system initiation, adjustment, and fine tuning.
 5. Start-up shall not be considered complete until the sequence of operation, including alarms, has been sufficiently demonstrated to the Owner or Owner's designated representative. This jobsite visit shall occur only after hook-ups, tie-ins, and terminations have been completed and signed-off on the manufacturer's start-up request form.
- B. Follow Closeout procedures as per Division 1.
- C. Provide Demonstration and Training in accordance Division 1.

- D. Provide Project Record Documents in accordance with Division 1. In addition, per ASHRAE 90.1-2016: Provide record drawings of the actual installation to the building owner. Record drawings shall include, as a minimum, the location and performance data on each piece of equipment; general configuration of the duct and pipe distribution system, including sizes; and the terminal air or water design flow rates.
- E. Provide Operation and Maintenance information in accordance with Division 1. In addition, per ASHRAE 90.1: Provide an operating manual and a maintenance manual to the building owner. Manuals shall include, at a minimum, the following:
 - 1. Submittal data stating equipment size and selected options for each piece of equipment requiring maintenance.
 - 2. Operation manuals and maintenance manuals for each piece of equipment and system requiring maintenance, except equipment not furnished as part of the project. Required routine maintenance actions shall be clearly identified.
 - 3. Names and addresses of at least one service agency.
 - 4. HVAC controls system maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined set points shall be permanently recorded on control drawings at control devices or, for digital control systems, in programming comments.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division Section: "Common Work Results"

1.02 SUMMARY

- A. Testing, Adjusting, and Balancing

1.03 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Reports:
 - 1. Deficiency Report: Following examination of installed system, prior to balancing, submit report indicating system deficiencies that would prevent proper testing, adjusting, and balancing of systems and equipment to meet specified performance.
 - 2. TAB Report: Submit the complete testing, adjusting, and balancing report, including any drawings indicating air outlets, thermostats, and equipment identified to correspond with data sheets.
 - 3. Reports shall be on TABB/SMACNA, AABC, or NEBB forms that indicate information addressing each of the testing methods, readings, and adjustments.
- C. Closeout Submittals: Provide complete copy of TAB report. Include report in Operation and Maintenance Manual.

1.04 QUALITY ASSURANCE

- A. An independent entity shall perform the TAB work.
- B. Special Warranty
 - 1. Provide warranty for period of 90 days following submission of completed report, during which time Owner may request a recheck of up to 10% of total number of terminals, or resetting of any outlet, coil, or device listed in the test report.
 - 2. Warranty shall meet the requirements of the following programs:

- a. TABB – Quality Assurance Program
 - b. AABC – National Project Performance Guarantee
 - c. NEBB – Conformance Certification
- C. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."
- E. TAB is required to comply with governing codes and requirements of authorities having jurisdiction.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 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.
 - 1. Systems are started and operating in a safe and normal condition.
 - 2. Temperature control systems are installed, complete, and operable.
 - 3. Verify HVAC control system is operating within the design limitations.
 - 4. Confirm that the sequences of operation comply with Contract Documents.
 - 5. Automatic and manual dampers are operable and fully open.
 - 6. Verify that controllers are calibrated and function as intended.
 - 7. Verify that controller set points are as indicated.
 - 8. Verify the operation of lockout or interlock systems.
 - 9. Verify the operation of valve and damper actuators.
 - 10. Verify that controlled devices are properly installed and connected to correct controller.
 - 11. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
 - 12. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.
 - 13. Suitable access to balancing devices and equipment is provided.
 - 14. Thermal overload protection is in place for equipment.
 - 15. Start-up air filters are removed.
 - 16. Final filters are clean and properly installed.
 - 17. Duct and fan systems are clean.
 - 18. Fans are rotating correctly.
 - 19. Life safety and volume dampers are in place and open.
 - 20. Air coil fins are cleaned and combed.
 - 21. Access doors are closed, and duct end caps are in place.
 - 22. Air outlets are installed and connected.
 - 23. Hydronic systems are pressure tested, flushed, filled, and properly vented.
 - 24. Leak testing on duct system has been performed.
 - 25. Pumps are rotating correctly.
 - 26. Start-up/construction strainers have been removed and all permanent strainers are clean and in place.
 - 27. Gauges and/or test ports are properly located for balancing.

28. Service and balance valves are fully open.

- B. If deficiencies are evident, submit Deficiency Report to Architect. Do not begin testing, adjusting, and balancing of environmental systems until deficiencies have been remedied.

3.02 AIR SYSTEMS PROCEDURES

- A. Adhere to the follow procedure:

1. TABB – SMACNA TAB Procedural Guide, with particular focus on the following chapters: Preliminary TAB Procedures, General Air System TAB Procedures, & TABB Procedures for Specific Air Systems.
2. AABC – National Standards for Total System Balance.
3. NEBB – Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

- B. Minimum air procedures shall include the following:

1. Provide TAB for all air systems and components.
2. Test and adjust fan RPM to design requirements.
3. Test and record motor full load nameplate rating and actual ampere draw.
4. Test and record system static pressures, fan suction, and discharge.
5. Adjust all main supply and return air duct to within tolerances of proper design CFM.
6. Test and adjust each diffuser, grille, and register. Reading and tests of diffusers, grilles, and registers shall include design velocity (FPM) and adjusted velocity, design CFM, and adjusted CFM.
7. Test and record outside air, mixed air, and discharge temperatures (D.B. for heating cycle, D.B. and W.B. for cooling cycle).
8. In coordination with the BAS contractor, set adjustments of automatically operated dampers to operate as specified, indicated and/or noted.
9. Test and adjust air handling and distribution systems to provide required supply, return, outside, and exhaust air quantities within design tolerance.
10. Make air velocity measurements in ducts by Pitot tube traverse across entire cross-sectional area of duct in accordance with SMACNA equal area method or Log Linear method.
11. Measure air quantities at all air inlets and outlets.
12. Use volume control devices to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels.
13. Vary total system air quantities by adjustment of fan speeds. Provide drive changes recommendations. Vary branch air quantities by damper regulation.
14. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for loading of filters and coils.
15. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions within specified tolerances.
16. Where modulating dampers or economizers are provided, take measurement at full return air, minimum outside air, and 100% outside air mode of operation.
17. For airflow monitoring devices to perform as intended, field calibration is required. Provide measurement of airflow to assist with calibration.

- C. Set system's airflow rates within the following tolerances:

1. Air Handling Systems: Adjust to within plus 10 percent of outlet total plus allowable leakage rate.
2. Air Outlets and Inlets: Adjust total to within plus or minus 10 percent of design for the space.
3. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.03 HYDRONIC SYSTEM PROCEDURES

- A. Adhere to the follow procedure:
1. TABB – SMACNA TAB Procedural Guide, with particular focus on the following chapter: Hydronic System TAB Procedures.
 2. AABC – National Standards for Total System Balance.
 3. NEBB – Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
- B. Hydronic balancing shall include the following minimum data:
1. Provide TAB for all hydronic systems and components.
 2. Prepare itemized equipment schedules listing all heating and/or cooling elements and equipment in the systems to be balanced. List in order on equipment schedules, by pump or zone according to the design, all heating and/or cooling elements, all zone balancing valves, and circuit pumps, ending with the last items of equipment or transfer element in the respective zone or circuit. Include on schedule sheet column titles listing the location, type of element or apparatus, design conditions, and measured conditions. Prepare individual pump report sheets for each zone or circuit.
 3. Adjust hydronic systems to provide plus or minus 10 percent of required design quantities.
 4. Use calibrated Venturi tubes, orifices, metered fittings, pressure gages, and direct-reading instrumentation to determine flow rates for system balance. Where flow-metering devices are not installed, flow balance on temperature difference across various heat transfer elements in the system is acceptable.
 5. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
 6. Effect system balance with automatic control valves fully open to heat or cooling transfer elements.
 7. Adjust hydronic distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
 8. Test pumps and adjust flow. Record the following on pump report sheets:
 - a. Suction and discharge pressure.
 - b. Running amps and brake horsepower of pump motor under full flow and no flow conditions.
 - c. Pressure-drop across pump in feet of water and total GPM pump is handling under full flow conditions.
 9. Where available pump capacity is less than total flow requirements or individual system parts, proportional balancing must be performed.
- C. Set system's water flow rates within the following tolerances:
1. Hydronic Systems: Adjust to within 10 percent of design flow.
 2. Hydronic terminal devices: Adjust to within plus or minus 10 percent of design flow.

3.04 ADJUSTING

- A. Recorded data shall represent actual measured or observed conditions.
- B. Permanently mark the setting of valves, dampers, and other adjustment devices allowing for settings to be restored. Set and lock memory stops.

- C. Final report to include identification of all key outlets, key branches, and key trunks in each air system that shows a critical path of no dampening from the fan to terminal device.
- D. Final report to include identification of all key terminal devices, key branches, and key trunks in each hydronic system that shows a critical path of no throttling of valves from the pump to terminal device.
- E. Leave systems in proper working order by replacing guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

END OF SECTION

SECTION 23 07 00
MECHANICAL INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 7 for firestopping materials and requirements for penetrations through fire and smoke barriers.
 - 2. Division 23 Section "Common Work Results for Mechanical"
 - 3. Division 23 Section "Metal Ducts" for duct liner.
 - 4. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. This Section includes insulation and related components for Division 22 & Division 23.

1.03 ACTION SUBMITTALS

- A. Product Data: Identify thermal conductivity, Greenguard Certification, thickness, and jackets (both factory and field applied, if any), for each type of product indicated. For adhesives and sealants, provide documentation including printed a statement of VOC content.
- B. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing 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.
- C. Indoors: Materials shall have a flame spread index of less than 25 and a smoke developed index of less than 50 when tested in accordance with ASTM E 84, latest revision.
- D. Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

- E. Provide accessory materials as part of insulation work under this section shall include closure materials, adhesives, mastics, and support materials; shall be as recommended by insulation material manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.
- B. All of the insulation materials and accessories covered by this specification shall be delivered to the job site and stored in a safe, dry place with appropriate labels and/or other product identification.
- C. Store tapes, adhesives, mastics, cements, and insulation materials in ambient conditions in accordance with the recommendations of the manufacturer.
- D. Follow manufacturer's recommended handling practices.
- E. The contractor shall use whatever means are necessary to protect the insulation materials and accessories before, during, and after installation. No insulation material shall be installed that has become damaged in any way. The contractor shall also use all means necessary to protect work and materials installed by other trades.
- F. Fiber Glass and Mold: Contractor shall take precaution to protect insulation. Any fiber glass insulation that becomes wet or torn should be replaced at no additional cost. Air handling insulation used in the air stream must be discarded if exposed to water.

1.06 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields. Coordinate clearance requirements with other trades for insulation application.
- B. Schedule insulation application after testing systems. Insulation application may begin on segments of systems that have satisfactory test results.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Certainteed
 - 2. Knauf
 - 3. Owens-Corning
 - 4. John Mansville
 - 5. Armstrong
 - 6. Aeroflex USA
 - 7. Nomaco K-Flex
 - 8. Pabco.

2.02 PIPING INSULATION MATERIALS

A. Glass Fiber:

1. Knauf 1000° Pipe Insulation with ECOSE Technology meeting ASTM C547 Type IV Grade A, ASTM C585, and ASTM C795; rigid, molded, noncombustible per ASTM E136; k value: ASTM C335, 0.23 at 75°F mean temperature. Maximum Service Temperature: 1000°F, or Johns Manville's Micro-Lok® HP meeting ASTM C547, Type I, maximum service temperature of 850°F meeting the other requirements. Vapor Retarder Jacket: ASJ/SSL conforming to ASTM C1136 Type I, secured with self-sealing longitudinal laps and butt strips.
2. PVC Fitting Covers: The Proto Fitting Cover System or Johns Manville Zeston® polyvinyl chloride (PVC) parts shall consist of one piece and two piece pre-molded high impact UV-resistant PVC fitting covers with fiberglass inserts and accessories, which include elbows, tee/valves, end caps, mechanical line couplings, and specialty fittings. Fittings shall be made of Zeston® or LoSMOKE® grade PVC, 25/50 rated per ASTM E-84. Thermal Value of fiberglass insert: K value of 0.26 at 75°F; resistance to fungi and bacteria. (ASTM G 21, ASTM G 22): does not promote growth of fungi or bacteria.

B. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
3. Materials shall have a maximum thermal conductivity of 0.27 Btu-in/h-ft²- °F at a 75°F mean temperature when tested in accordance with ASTM C 177 or ASTM C 518, latest revisions.
4. Materials shall have a maximum water vapor transmission of 0.08 perm-inches when tested in accordance with ASTM E 96, Procedure-A, latest revision.
5. Provide Armaflex WB finish for outdoor exposed piping.

C. Field-Applied Jackets For Piping: ASTM C 921, Type 1, unless otherwise indicated.

1. PVC: Johns Manville's Zeston® PVC fittings, jacketing, and accessories or Proto Corporation 25/50 or Indoor/Outdoor, UV-resistant fittings, jacketing and accessories, white. The fitting cover system consists of pre-molded, high-impact PVC materials with fiber glass inserts. Fiber glass insert has a thermal conductivity (k value) of 0.26 at 75° F mean temperature. Closures: stainless steel tacks, matching PVC tape, or PVC adhesive per manufacturer's recommendations.
2. Metal jackets: provide with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.
3. Aluminum Jacket: Factory cut and rolled to required size. Comply with ASTM B 209, 3003 alloy, and H-14 temper. Finish and Thickness: Corrugated finish, 0.010 inch thick. Moisture Barrier: 1-mil- thick, heat-bonded polyethylene and Kraft paper. Elbows: Preformed, 45- and 90-degree, short- and long-radius elbows; same material, finish, and thickness as jacket.

2.03 DUCTWORK INSULATION MATERIALS

- A. Flexible Fiber Glass Blanket: Glass Mineral Wool Blanket Insulation: Glass Mineral Wool bonded with a bio-based thermosetting resin. Comply with ASTM C 553, Types I, II, and III, ASTM C 1136 Type II, and ASTM C 1290, Type III. UL/ULC Classified per UL 723 for FSK, FHC 25/50 per ASTM E 84 for PSK only.
1. Factory-applied jacket: ASJ: White, Kraft paper, fiberglass reinforced scrim with aluminum foil backing; complying with ASTM C 1136, Type I.
 2. Basis-of-Design Product: Subject to compliance with requirements, provide Knauf Insulation; Atmosphere Duct Wrap.
 3. Density: 1.5 PCF
 4. R-Value: R6.0 minimum for 1-1/2" thick blanket ($k=0.25$).
- B. Rigid Fiber Glass Board: Johns Manville's 817 Series Spin-Glass® or Knauf Insulation Board with ECOSE Technology meeting ASTM C 612 Type IA and IB; rigid. Maximum Service Temperature: 450°. Density: Minimum 3.0 PCF; R4.2 per inch. Vapor Retarder Jacket: ASJ conforming to ASTM C1136 Type I, or FSK or PSK conforming to ASTM C1136 Type II in combination with protective jacket where necessary. R-Value: R6.0 minimum for 1-1/2" thick blanket ($k=0.25$).
- C. Exterior Ductwork:
1. Insulation: Flexible Elastomeric: Closed-cell or expanded-rubber materials; suitable for maximum use temperature between minus 70°F and 220°. Comply with ASTM C534, Type II for sheet materials.
 - a. Thermal Resistance: R12 Minimum.
 - b. Compressive Strength, ASTM D 1621: 16 psi or greater.
 - c. Flexural Strength, ASTM C 203: 40 psi or greater.
 - d. Water Absorption, ASTM C 209: 0.1 percent by volume.
 - e. Water Vapor Permeance, ASTM E 96, 0.05 perms.
 2. Insulation: Rigid foam insulating sheathing, complying with ASTM C 1289; closed cell polyisocyanurate, CFC- and HCFC-free.
 - a. Thermal Resistance, ASTM C 518: R12 Minimum.
 - b. Compressive Strength, ASTM D 1621: 16 psi or greater.
 - c. Flexural Strength, ASTM C 203: 40 psi or greater.
 - d. Water Absorption, ASTM C 209: 0.1 percent by volume.
 - e. Water Vapor Permeance, ASTM E 96, 0.05 perms.
 3. High-performance jacketing: VentureClad-1577, Polygard-Alumagard All-Weather, or approved equal; high performance jacketing product shall perform well over a wide temperature range; -30°F to +300°F service temperature.
 - a. Zero permeability, absolute vapor barrier; High puncture and tear resistance
 - b. Contain tested and approved mold inhibiting agents.
 - c. A 5-ply self-adhesive material shall be installed easily with no off-site fabrication required. The cold weather acrylic adhesive shall apply easily at temperatures as cold as minus 10°F.
 - d. Flame spread/smoke developed: 10/20 (UL 723)
 - e. 6-mil thickness (PSTC-133); Provide in natural aluminum stucco embossed finish.

PART 3 - EXECUTION

3.01 GENERAL APPLICATION REQUIREMENTS

- A. Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature. Insulation materials and accessories covered by this specification shall be delivered to the job site and stored in a safe, dry place with appropriate labels and/or other product identification. Store tapes, adhesives, mastics, cements, and insulation materials in ambient conditions in accordance with the recommendations of the manufacturer. Follow manufacturer's recommended handling practices. The contractor shall use whatever means are necessary to protect the insulation materials and accessories before, during, and after installation. No insulation material shall be installed that has become damaged in any way. The contractor shall also use all means necessary to protect work and materials installed by other trades. Contractor shall take precaution to protect insulation. Any fiber glass insulation that becomes wet or torn should be replaced at no additional cost. Air handling insulation used in the air stream must be discarded if exposed to water.
- B. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application. Verify that systems to be insulated have been tested and are free of defects. Verify that surfaces to be insulated are clean and dry. Proceed with installation only after unsatisfactory conditions have been corrected. Before starting work under this section, carefully inspect the site and installed work of other trades and verify that such work is complete to the point where installation of materials and accessories under this section can begin. Ensure that pipe and fitting surfaces over which insulation is to be installed are clean and dry. Ensure that insulation is clean, dry, and in good mechanical condition with factory-applied vapor or weather barriers intact and undamaged. Wet, dirty, or damaged insulation shall not be acceptable for installation. Ensure that pressure testing of piping and fittings has been completed prior to installing insulation.
- C. Installer Qualifications: Skilled mechanics shall have successfully completed an apprenticeship program or another craft training program.
- D. Provide insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout, including the length of ducts and fittings, valves, and specialties. Provide per "National Commercial & Industrial Insulation Standards" – MICA Manual.
- E. Provide insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each system as specified in insulation system schedules.
- F. Provide accessories compatible with insulation materials and suitable for the service.
- G. Provide insulation with longitudinal seams at top and bottom of horizontal pipe runs and equipment. Provide multiple layers of insulation with longitudinal and end seams staggered.
- H. There shall be no glass fibers exposed to the air. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- I. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- J. Jackets And Finishes: Draw jacket tight and smooth. 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. Overlap jacket longitudinal

seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c. For below ambient services, apply vapor-barrier mastic over staples. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

- K. Keep insulation materials dry during application and finishing.
- L. Provide insulation over fittings, valves, and specialties, with continuous thermal and the least number of joints practical.
- M. Provide removable insulation covers at fittings and equipment that require servicing and locations with service requirements.
- N. Locate seams in the least visible location.
- O. Cold surfaces that may "sweat" must be insulated. Vapor barrier must be maintained, insulation shall be applied with a continuous, unbroken moisture and vapor seal.
 - 1. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
 - 2. Hangers, supports, anchors, or other projections that are secured to cold surfaces shall be insulated and vapor sealed to prevent condensation.
 - 3. Seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 4. Provide insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity.
 - 5. 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. Provide insert materials and provide insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- P. For above-ambient services, do not install insulation to the following: testing agency labels and stamps, nameplates, and cleanouts.
- Q. Insulation thicknesses and installations shall meet or exceed the requirements of the local energy code, or thicknesses indicated, whichever is of superior insulating performance. If piping type is omitted from list below, provide insulation per energy code or as per similar duty.
- R. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- S. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- T. Insulate instrument connections for specialties (examples: thermometers, sensors, etc.) 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.
- U. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

- V. 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.
- W. Penetrations
 - 1. Division 7 for firestopping materials and requirements for penetrations through fire and smoke barriers.
 - 2. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Provide insulation continuously through walls and partitions.
 - 3. Insulation Installation at Roof or Aboveground Exterior Wall Penetrations: Provide insulation continuously through penetrations.
 - a. Seal penetrations with flashing sealant.
 - b. For applications requiring only indoor insulation, terminate insulation above roof/wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, provide insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - c. Extend jacket of outdoor insulation outside roof/wall flashing at least 2 inches below top of roof flashing.
 - d. Seal jacket to roof/wall flashing with flashing sealant.
 - 4. Insulation Installation at Fire-Rated Penetrations:
 - a. Fire Dampers: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
 - b. Pipe or duct penetrations (no fire damper): Provide insulation continuously through penetrations of fire-rated walls and partitions. Comply with requirements in Division 7 for firestopping and fire-resistive joint sealers.

3.02 INSTALLATION OF PIPING INSULATION

- A. Metal shields shall be provided between hangers or supports and the piping insulation.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. 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 and finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 2. 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 close to the next and hold in place with tie wire. Bond pieces with adhesive.
 - 3. Insulate 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.
 - 4. For below-ambient services, provide a design that maintains vapor barrier.
 - 5. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Provide 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.

6. 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.
7. For services not specified to receive a field-applied jacket except for flexible elastomeric, provide fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

C. Flexible Elastomeric Insulation

1. Seal longitudinal seams and end joints with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
2. Insulation Installation on Pipe Flanges: Provide pipe insulation to outer diameter of pipe flange. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation. Secure insulation to flanges and seal seams with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
3. Insulation Installation on Pipe Fittings and Elbows: Provide mitered sections of pipe insulation. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
4. Insulation Installation on Valves and Pipe Specialties: Provide preformed valve covers manufactured of the same material as pipe insulation when available. When preformed valve covers are not available, provide cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. Provide insulation to flanges as specified for flange insulation application. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
5. After the adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating. Prior to applying the finish, the insulation shall be wiped clean with denatured alcohol. The finish shall not be tinted. To insure good adhesion, the temperature should be above 50°F during application and drying.
6. Outdoor exposed piping shall be painted with two coats of Armaflex WB Finish. Prior to applying the Finish, the insulation shall be wiped clean with denatured alcohol. The Finish shall not be tinted. Outdoor exposed piping shall have seams located on the lower half of the pipe.

3.03 PIPE APPLICATION SCHEDULE

- A. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements. For piping systems not indicated, insulate to with a similar thickness and type as those specified. Insulation thicknesses and installations shall meet or exceed the requirements of the local energy code, or thicknesses indicated, whichever is of superior insulating performance.
- B. PVC jackets shall be provided with 1-inch overlap at longitudinal seams and end joints, for horizontal applications. Seal with manufacturers recommended adhesive. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge. Provide PVC jackets in the following locations:

1. For piping exposed in mechanical rooms within 6 feet above finished floor or high traffic areas.
 2. Exposed vertical piping in finished spaces.
 3. Exposed piping in classrooms, and public areas.
- C. Outdoor Piping where heat tracing is provided:
1. Pipe size 2-1/2" and less: Glass Fiber, 1-1/2" thickness; Jacket: Aluminum.
 2. Pipe size 3" and larger: Glass Fiber, 2" thickness; Jacket: Aluminum.
- D. Domestic hot water:
1. Runouts and non-recirculated portions: Glass Fiber 1/2" thickness.
 2. Recirculating piping including the supply and return: 1-1/4" and less: Glass Fiber, 1" thickness; 1-1/2" and larger: Glass Fiber, 1.5" thickness.
 3. Heat traced DHW piping: 1-1/4" and less: Glass Fiber, 1" thickness; 1-1/2" and larger: Glass Fiber, 1.5" thickness.
- E. Domestic cold water: Glass Fiber, 1/2" thickness.
- F. Rainwater conductors: Glass Fiber, 1" thickness. Provide for horizontal piping and any vertical piping within 10 feet of the roof drain.
- G. Roof Drain Bodies: Flexible Elastomeric, 1/2" thickness. Alternative: Roof drain bowls may be insulated with 2" of closed-cell spray-foam provided by Division 7. Coordinate with Division 7.
- H. Rainwater conductors, heat traced: Glass Fiber, 2" thickness.
- I. AC pan drain or other cold drain piping: Glass Fiber, 1/2" thickness.
- J. Refrigerant:
1. Pipe size 1-1/4" and less: Glass Fiber, 1/2" thickness.
 2. Pipe size 1-1/2" and larger: Glass Fiber, 1" thickness.
 3. VRF: Insulate piping in accordance with VRF manufacturer's instructions.
 4. Ductless split: 3/4" Armaflex for liquid and gas piping; and/or insulated line kits as specified in Section 23 81 30. Insulation shall be plenum rated.
- K. Heating hot water supply and return:
1. 105F to 140F HWS:
 - a. Pipe size 1-1/4" and less: Glass Fiber; 1-1/2" thickness.
 - b. Pipe size 1-1/2" and larger: Glass Fiber; 2" thickness.
 2. 141F to 200F HWS:
 - a. Pipe size 1-1/4" and less: Glass Fiber; 1" thickness.
 - b. Pipe size 1-1/2" and larger: Glass Fiber; 1-1/2" thickness.
 3. Insulation is not required for exposed piping through floor for convectors and radiators.
 4. Insulation is not required strainers, control valves, unions, and balancing valves associated with piping 1" or less diameter. Insulate piping to within approximately 3/4-inch of un-insulated items.

3.04 INSTALLATION OF DUCTWORK INSULATION

- A. Flexible Fiberglass Blanket Insulation Installation:
1. Secure with adhesive and insulation pins. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces. Apply adhesive to entire circumference of ducts and to surfaces of fittings and transitions.
 2. Firmly butt joints.
 3. Provide 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.
 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. Provide insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Provide 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.
- B. 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 100 percent coverage of duct and plenum surfaces. Apply adhesive to entire circumference of ducts and to surfaces of fittings and transitions.
 2. Provide 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.
 3. Provide 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. Provide insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 4. 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.
- C. For ducts and plenums with surface temperatures below ambient, provide a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Provide vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal. Provide vapor stops for ductwork and plenums operating below 50°F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
- D. Fire-rated insulation system installation: Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating. Insulate duct access panels and doors to achieve the same fire rating as duct.

3.05 DUCTWORK APPLICATION SCHEDULE

- A. For duct systems not indicated, insulate to with a similar thickness and type as those specified. Insulation thicknesses and installations shall meet or exceed the requirements of the local energy code, or thicknesses indicated, whichever is of superior insulating performance.
- B. Application schedules identify ductwork thickness, and jacket requirements. For duct systems not indicated, insulate to with a similar thickness and type as those specified. Insulation thicknesses and installations shall meet or exceed the requirements of the local energy code, or thicknesses indicated, whichever is of superior insulating performance.
- C. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment: Flex connectors, metal ducts with duct liner, factory-insulated flexible ducts, factory-insulated plenums, casings, and access doors.
- D. Supply Ducts:
 - 1. Concealed or Unconditioned: Flexible Fiber Glass Blanket; 1.5" thickness, R6 minimum.
 - 2. Exposed to heated or non-air conditioned spaces: Flexible Fiber Glass Blanket; 1.5" thickness R6 minimum.
 - 3. Exposed to Air-Conditioned Space: None
 - 4. Indirectly conditioned spaces (plenum returns, crawl spaces,): R1.9 minimum.
 - 5. Ventilated Attic, exterior, or unconditioned spaces: R-12, 3" thickness.
- E. Relief, outside air, or exhaust plenums at louvers: Rigid Fiberglass Board; 2" thickness.
- F. OA ducts between the intake plenum and the air handling unit: Flexible Fiber Glass Blanket; 1.5" thickness, R6 minimum.
- G. Relief or exhaust ducts within 20 feet of the exterior: Flexible Fiber Glass Blanket; 1.5" thickness, R6 minimum.
- H. Return ducts within conditioned space: None required.
- I. Exterior Supply & Return Ducts: 2-1/2" Rigid Roof Insulation Board with high performance jacket; R12 minimum.
- J. Ducts subject to damage from maintenance personnel: Rigid Fiber Glass Board, R-6, with 16 gauge sheet metal covering (provided by Section 23 31 13) on top and both vertical sides. Covering shall be 48" in width (when possible) where personnel will cross duct to access valves, etc.

END OF SECTION

SECTION 23 09 00

DIRECT DIGITAL CONTROL (DDC) SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide all labor, materials, special tools, equipment, enclosures, power supplies, interfaces, wiring, tubing, installation, labeling, calibration, documentation, submittals, testing, verification, training services, warranty, specified services and items required by the Contract that are required for the functional turn-key operation of the complete and fully functional Controls Systems. Documents are diagrammatic only. Equipment and labor not specifically referred to herein or on the plans, which are required to meet the functional intent, shall be provided without additional cost to the Owner.
- B. Provide wiring, technical expertise, and components for complete functioning, stand-alone systems. Review the equipment manufacturer's instructions, modify/provide proper sequencing per manufacturer's requirements. Provide items as required for the sequences and control components in the equipment specification sections.
- C. Functions called for in sequence of operations are minimum requirements and not to limit additional system capabilities. Determine, through operation of the system, proportional bands, interval time, integral periods, adjustment rates, and any other input information required to provide stable operation of the control programs.
- D. All setpoints shall be monitored and adjustable. Setpoints listed herein are approximate. It is the responsibility of the contractor to calibrate the system and all setpoints to actual working conditions once the system is on line.
- E. Sequences of operation are intended to be performance based. Provide components and wiring to meet sequences and system intent. Implementations that provide the same functional result using different underlying detailed logic will be acceptable.
- F. Provide a new Building Automation System (BAS) to integrate and control all mechanical equipment associated with this project.
 - 1. The Building Automation System shall be as indicated on the drawings and described in these specifications. System must be fully integrated and coordinated with mechanical equipment DDC controllers furnished and installed in the equipment manufacturer's factory as specified in those sections. The intent of the BAS is to integrate all mechanical equipment into one system for global monitoring, control, and alarming associated with the building. It is the BAS manufacturer's responsibility to provide all the design, engineering, and field coordination required to ensure all equipment sequence of operations are met as specified and the designated BAS operators have the capability of managing the building mechanical system to ensure occupant comfort while maintaining energy efficiency.
 - 2. The BAS shall meet open standard protocol communication standards (As defined in System Communications Section) to ensure the system maintains "interoperability" to avoid proprietary arrangements that will make it difficult for the Owner to consider other BAS manufacturers in future projects.
 - 3. Direct Digital Control (DDC) technology shall be used to provide the functions necessary for control of mechanical systems and terminal devices on this project.

4. Approved vendors, products and web services shall comply with SOC2 Type II as defined by the AICPA. SOC2 Type II compliance is a certification that confirms that a service provider has established and implemented effective controls to secure their clients' data in accordance with the Trust Services Criteria (TSC).
 - a. SOC2 Type II compliance provides assurance to customers that the service provider has established and implemented effective security controls and is committed to protecting their data.
 - b. To achieve SOC2 Type II compliance, the manufacturer shall have completed an independent audit to assess design and implementation of their controls, policies, and procedures.
5. The BAS shall accommodate simultaneous multiple user operation. Access to the control system data should be limited only by the security permissions of the operator role. Multiple users shall have access to all valid system data. An operator shall be able to log onto any workstation on the control system and have access to all appropriate data.

G. Related Sections include the following:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
2. Division 13 Section "Fire Alarm"
3. Division 23 Section "Common Work Results for Mechanical"
4. Division 23 Sections controls shall be integrated by this section.
5. Division 23 Section "Testing, Adjusting, and Balancing"
6. Division 26
7. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Elementary wiring diagrams of controls for HVAC equipment motor circuits including interlocks, switches, relays and interface to DDC controllers.
- C. Narrative sequence of operation.
- D. Schedule and design calculations for control valves and actuators.
- E. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- F. BAS manufacturer shall provide shop drawings and manufacturers' standard specification data sheets on all hardware and software being provided for this project. No work may begin on any segment of this project until the Engineer and Owner have reviewed submittals for conformity with the plan and specifications.
 1. Provide three (3) printed copies of submittal package for review and approval.
 - a. Quantities of items submitted shall be reviewed by the Engineer and Owner. Such review shall not relieve the BAS manufacturer of furnishing quantities required based upon contract documents.

2. Provide the Engineer and Owner, any additional information or data which is deemed necessary to determine compliance with the specifications or which is deemed valuable in documenting and understanding the system to be installed.
3. All shop drawings shall be provided to the Owner electronically as .dwg or .dxf file formats once they have been approved and as-built drawings have been completed.
4. Submit the following within 90 days of contract award:
 - a. A complete bill of materials of equipment to be used indicating quantities, manufacturers and model numbers.
 - b. A schedule of all control valves including the valve size, pressure drop, model number (including pattern and connections), flow, CV, body pressure rating, and location.
 - c. A schedule of all control dampers including damper size, pressure drop, manufacturer, and model number.
 - d. Provide all manufacturers' technical cut sheets for major system components. When technical cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Include:
 - 1) Building Controllers
 - 2) Custom Application Controllers
 - 3) Application Specific Controllers
 - 4) Operator Workstations
 - 5) Portable Operator Terminals
 - 6) Auxiliary Control Devices
5. Provide proposed Building Automation System architectural diagram depicting various controller types, workstations, device locations, addresses, and communication cable requirements
6. Provide detailed termination drawings showing all required field and factory terminations, as well as terminal tie-ins to DDC controls provided by mechanical equipment manufacturers. Terminal numbers shall be clearly labeled.
7. Provide a sequence of operation for each controlled mechanical system and terminal end devices.
8. Provide a BACnet Protocol Implementation Conformance Statement (PICS) for each BACnet system level device (i.e. Building Controller & Operator Workstations) type. This defines the points list for proper coordination of interoperability with other building systems if applicable for this project.

1.03 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data
- B. Project Record Documents: Upon completion of installation, submit three (3) copies of record (as-built) documents. The documents shall be submitted for approval prior to final completion and include:
 1. Project Record Drawings - These shall be as-built versions of the submittal shop drawings. One set of electronic media including CAD .dwg and .pdf drawing files shall be provided.
 2. Testing and Commissioning Reports and Checklists signed off by trained factory (equipment manufacturers) and field (BAS) commissioning personnel.
 3. Operating and Maintenance (O & M) Manuals - These shall be as-built versions of the submittal product data. In addition to the information required for the submittals, Operating & Maintenance manual shall include:

- a. Procedures for operating the BAS including logging on/off, alarm management, generation of reports, trends, overrides of computer control, modification of setpoints, and other interactive system requirements.
 - b. Explanation of how to design and install new points, new DDC controllers, and other BAS hardware.
 - c. Documentation, installation, and maintenance information for all third party hardware/software products provided including personal computers, printers, hubs, sensors, valves, etc.
 - d. Original issue media for all software provided, including operating systems, programming language, operator workstation software, and graphics software.
 - e. Licenses, Guarantee, and Warranty documents for all equipment and systems.
- C. Training Manuals: The BAS manufacturer shall provide a course outline and copies of training manuals at least two weeks prior to the start of any corporate training class to be attended by the Owner.

1.04 QUALITY ASSURANCE

- A. All products used in this project installation shall be new and currently under manufacture and shall have been applied in similar installations for a minimum of two years. This installation shall not be used as a test site for any new products unless explicitly approved by the owner's representative in writing. Spare parts shall be available for at least five years after completion of this contract.
- B. Use only employees who are qualified, skilled, experienced, and familiar with the specific equipment, software and configurations to be provided for this Project.
- C. Provide a complete, neat and workmanlike installation.
- D. All work, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of the local, state, and federal authorities. Such codes, when more restrictive, shall take precedence over these plans and specifications.
- E. 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.
- F. Comply with NFPA 90A and IMC-2021.
- G. Comply with ASHRAE 135 for DDC system control components.
- H. The contractor shall protect all work and material from damage by his/her work or employees. The contractor shall be responsible for his/her work and equipment until finally inspected, tested, and accepted. The contractor shall protect any material that is not immediately installed. The contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.
- I. Codes and Standards: Meet requirements of all applicable standards and codes, except when more detailed or stringent requirements are indicated by the Contract Documents, including requirements of this Section.
 - 1. Underwriters Laboratories: Products shall be UL-916-PAZX listed.
 - 2. National Electrical Code -- NFPA 70.
 - 3. Federal Communications Commission -- Part J.

4. ASHRAE/ANSI 135-2012 (BACnet) - Controllers shall conform to the listed version of the BACnet specification to improve interoperability with various building system manufacturers' control systems and devices.

J. BACnet Specific Definitions:

1. BACnet: Building Automation Control Network Protocol, ASHRAE 135. A communications protocol allowing devices to communicate data and services over a network.
2. BACnet Interoperability Building Blocks (BIBBs): BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBs are combined to build the BACnet functional requirements for a device.
3. BACnet MS/TP: MS/TP bus protocol is part of the BACnet ANSI/ASHRAE™ Standard 135-2008 that uses the EIA-485 (RS-485) physical layer standard for data transmission (called the segment). Multiple segments can be logically tied together.
4. BACnet-IP: Defines and allows using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP subnetworks that share the same BACnet network number.
5. BACnet Testing Laboratories (BTL): Organization responsible for testing products for compliance with ASHRAE 135, operated under direction of BACnet International.

1.05 CONTRACTOR QUALIFICATIONS

A. Qualified Bidders: System shall be as manufactured, installed, and serviced by:

1. Trane (Basis of Design)
2. Johnson Controls, Inc.
3. Honeywell
4. Siemens

B. The BAS Manufacturer shall have factory trained and certified personnel providing all engineering, service, startup, and commissioning field labor for the project from their local office location. BAS manufacturer shall be able to provide training certifications for all local office personnel upon request.

C. The BAS shall be provided by a single manufacturer and this manufacturer's equipment must consist of operator workstation software, web-based hardware/software, open standard protocol hardware/software, custom application programming language, graphical programming language, building controllers, custom application controllers, and application specific controllers. All other products specified herein (i.e., sensors, valves, dampers, actuators, etc.) need not be manufactured by the BAS manufacturer listed in this specification.

D. The BAS manufacturer shall have an established business office within 50.00 miles of the project site and must provide 24 hours/day, 7 days/week response in the event of a customer warranty or service call.

E. The BAS Manufacturer shall have factory trained and certified personnel providing all engineering, service, startup, and commissioning field labor for the project from their local office location. BAS manufacturer shall be able to provide training certifications for all local office personnel upon request.

F. The BAS shall be provided by a single manufacturer and this manufacturer's equipment must consist of operator workstation software, Web-based hardware/software, Open Standard Protocol hardware/software, Custom application Programming Language, Graphical Programming Language, Building Controllers, Custom Application Controllers, and Application Specific

Controllers. All other products specified herein (i.e., sensors, valves, dampers, actuators, etc.) need not be manufactured by the BAS manufacturer listed in this specification.

1.06 COORDINATION

- A. Where the mechanical work will be installed in close proximity to, or will interfere with, work of other trades, the contractor shall assist in working out space conditions to make a satisfactory adjustment. If the contractor installs his/her work before coordinating with other trades, so as to cause any interference with work of other trades, the contractor shall make the necessary changes in his/her work to correct the condition.
- B. Coordinate and schedule work with all other work in the same area, or with work that is dependent upon other work, to facilitate mutual progress.
- C. Coordinate location of thermostats and other exposed control sensors with plans and room details before installation.
- D. Coordination with controls specified in other sections or divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the controls system specified in this section. These controls shall be integrated into the system and coordinated by the contractor.
- E. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to unit manufacturer.
- F. Electrical Subcontractor: Complying with the principle of "unit responsibility" all electrical work for automatic controls, except as otherwise specified, or shown on the electrical drawings shall be included in Division 23. Electrical work shall, in general, comply with the following, unless otherwise directed by Division 26:
 - 1. Power wiring.
 - 2. All electrical work shall comply with the N.E.C. and local electrical codes.
- G. Coordinate with controls specified in other sections of divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated as follows:
 - 1. All communication media and equipment shall be provided as specified hereinafter.
 - 2. Each supplier of a control product is responsible for the configuration, programming, start-up, and testing of that product to meet the sequences of operation described in this section.
 - 3. Coordinate and resolve any incompatibility issues that arise between the control products provided under this section and those provided under other sections or divisions of this specification.

1.07 WARRANTY

- A. Refer to Division 1 Requirements.

1.08 SYSTEM MAINTENANCE AND REMOTE ANALYSIS

- A. The BAS Manufacture shall provide Building Automation System remote technical support and system analysis for a period of 1 year (beginning the date of substantial completion).
- B. The BAS manufacturer shall setup a secure remote connection for data collection, analytics and remote technical support for the HVAC systems included in this contract.
 - 1. Provide technician support during the warranty period to diagnose issues remotely through the secure remote connection.
 - 2. The building owner is responsible for providing adequate internet access.
- C. Connectivity / Remote Access / Network Security
 - 1. Provide and maintain secure remote access to the facilities Building Automation System (BAS) or other building systems. Users accessing service through this connection shall not have access to the building owners network. Secure remote access to the BAS shall not require ANY inbound ports on a firewall to be "exposed" or "forwarded".
 - 2. Secure remote access to the BAS shall be available anywhere, anytime, using a compatible client device (PC/tablet/phone)
 - 3. The Owner will provide up to Three (3) IP drops and IP addresses on the owners network to gain access to the internet. The BAS manufacture shall coordinate with the Owners IT team, verify the proposed system shall meet all network security requirements and any other network configuration information necessary to each control contractor for the purpose of configuring each Area Controller on the network. It shall be the responsibility of the BAS manufacture to coordinate with the owner for network connectivity.
- D. The BAS Manufacture shall provide a professional analysis for the facility HVAC systems.
 - 1. The analysis shall consist of an evaluation of HVAC systems including charts and graphs which indicate both current building performance and opportunities for building and HVAC system performance improvement.
- E. The following shall be provided after substantial completion of the project:
 - 1. Orientation meeting with the building owner's representative to identify the HVAC systems that will be evaluated.
 - 2. System setup for data collection and analytics. BAS Manufacture to setup a secure remote data collection and analytics for identified systems.
 - 3. Assessment analysis shall be performed by trained personnel with relevant professional credentials in HVAC systems, energy management and building optimization methodologies.
 - 4. Consultation meeting with owner to review performance reports and improvement opportunities.
- F. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of owner.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Products shall operate without performance degradation under ambient environmental temperature, pressure and humidity conditions encountered for installed location. If product alone cannot comply with requirement, install product in a protective enclosure that is isolated and protected from conditions impacting performance. Enclosure shall be internally insulated, electrically heated, cooled and ventilated as required by product and application. Products shall be protected with NEMA enclosures suitable for the location where installed.
- B. Continuity of Operation after Electric Power Interruption: Equipment and associated factory-installed controls, field-installed controls, electrical equipment, and power supply connected to building normal and backup power systems shall automatically return equipment and associated controls to operating state occurring immediately before loss of normal power, without need for manual intervention by operator when power is restored either through backup power source or through normal power if restored before backup power is brought online.
- C. Performance Standards. The BAS system shall conform to the following:
 - 1. Graphic Display. The system shall display a graphic with a minimum of 20 dynamic points. All current data shall be displayed within 10 seconds of the operator's request.
 - 2. Graphic Refresh. The system shall update all dynamic points with current data within 10 seconds.
 - 3. Object Command. The maximum time between the command of a binary object by the operator and the reaction by the device shall be 5 seconds. Analog objects shall start to adjust within 5 seconds.
 - 4. Object Scan. All changes of state and change of analog values shall be transmitted over the high-speed network such that any data used or displayed at a controller or workstation will be current within the prior 10 seconds.
 - 5. Alarm Response Time. The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed 10 seconds.
 - 6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.
 - 7. Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency from at least once every 5 seconds. The controller shall scan and update the process value and output generated by this calculation at this same frequency.
 - 8. Multiple Alarm Annunciations. All workstations on the network shall receive alarms within 5 seconds of each other.

2.02 SYSTEM COMMUNICATION

- A. Each workstation, building controller, and equipment controller communication interface shall utilize the BACnet™ protocol with an Ethernet (IEEE 802.3), Wi-Fi (IEEE 802.11), RS485 (EIA-485), or Zigbee® (802.15.4) physical interface and an appropriate data link technology as defined in ANSI®/ASHRAE® Standard 135-2012. (e.g. BACnet over IP, BACnet over IPv6, BACnet SC, BACnet over MS/TP, BACnet Zigbee).
- B. All system controllers shall be BTL listed as a BACnet Building Controller (B-BC) as defined in ANSI®/ASHRAE® Standard 135-2012.

- C. The system shall support both BACnet over IP and BACnet over MS/TP, allowing for a hybrid approach to meet various performance and cost requirements. Supporting both twisted-pair and Ethernet topologies to offer flexibility and cost-effectiveness.
- D. All documented status and control points, schedule, alarm, and data-log services or objects shall be available as standard object types as defined in ANSI®/ASHRAE® Standard 135-2012.
- E. The control system shall be capable of obtaining and using data from a RESTful API data server (e.g. current weather, forecast weather, etc.) to enhance energy efficiency, cost savings, and/or user comfort. The control system shall account for a communication loss to the API server such that the system will continue to operate.
- F. All Operator Workstations (B-OWS, B-AWS) and Building Controllers (B-BC) shall support BACnet Secure Connect (BACnet SC), a secure and encrypted datalink layer specifically designed for those networks.
- G. Each System Controller shall communicate with a network of Custom Application and Application Specific Controllers utilizing one or more of the interfaces documented within Field Bus Communications below.
- H. Field Bus Communications
 - 1. BACnet™
 - a. All equipment and plant controllers shall be BTL listed as a BACnet Application Specific Controller (B-ASC) or a BACnet Advanced Application Controller (B-AAC) as defined in ANSI®/ASHRAE® Standard 135-2012.
 - b. All communication shall conform to ANSI®/ASHRAE® Standard 135-2012.
 - c. System Controller shall function as a BACnet router to each unit controller providing a globally unique BACnet Device ID for all BACnet controllers within the system.
 - d. BACnet Zigbee®
 - 1) Communication between System Controller and equipment/plant controllers shall utilize BACnet Zigbee as defined in ANSI®/ASHRAE® Standard 135-2012.
 - 2) Each equipment controller wireless communication interface shall self-heal to maintain operation in the event of network communication failure.
 - 3) Each zone sensor wireless communication interface shall be capable of many-to-one sensors per controller to support averaging, monitoring, and multiple zone applications. Sensing options shall include temperature, relative humidity, CO2, and occupancy.
 - e. BACnet MS/TP
 - 1) Communication between System Controller and equipment/plant controllers shall utilize BACnet MS/TP as defined in ANSI®/ASHRAE® Standard 135-2012.
- I. Variable Refrigerant Flow (VRF) Communications
 - 1. The VRF system shall communicate with the BAS using one of the following communications methods.
 - a. The VRF system and the BAS shall utilize ANSI®/ASHRAE® Standard 135 (BACnet) protocol revision 12 or greater.

- b. Recognizing that VRF manufacturers utilize proprietary protocols to pass information between VRF equipment components. A gateway device is an accepted method to convert proprietary data to BACnet data. BACnet data shall conform to BACnet protocol revision 12 or greater.
 - c. When a device is capable of data exchange with the BACnet protocol across non-IP network segments, the BACnet protocol shall be used to exchange data. If a device does not support the BACnet protocol an alternative protocol may be used. Data exchanged using the alternative protocol shall be converted to the BACnet protocol to allow integration to the BAS.
2. To promote BAS interoperability, each instance of the following VRF system components shall be visible to the BAS network as a virtual BACnet device.
 - a. Indoor equipment
 - b. Outdoor equipment
 - c. Refrigerant manifold devices
 - d. Outdoor air ventilation systems
3. Virtual BACnet device functionality shall conform to BACnet protocol revision 12 or greater and meet the minimum functionality defined by BACnet device profile B-ASC.
4. The VRF indoor equipment shall support wireless zone sensors. Sensing options shall include temperature, relative humidity, CO2, and occupancy. Each zone sensor wireless communication interface shall be capable of many-to-one sensors per controller to support averaging, monitoring, and multiple zone applications.

2.03 OPERATOR INTERFACE

A. Provide Building Operator Web Interface

1. Manufacturer shall provide a user interface with time-of-day schedules, data collection, dashboards, reports and building summary, system applications, and self-expiring timed overrides. Manufacturer shall provide a published user and applications guide(s) that detail the system application operation, configuration, setup and troubleshooting.
2. The building operator web interface shall be accessible via a web browser without requiring any "plug-ins" (i.e. JAVA Runtime Environment (JRE), Adobe Flash).
3. User Roles
 - a. The system shall include pre-defined "roles" that allow a system administrator to quickly assign permissions to a user.
 - b. User logon/logoff attempts shall be recorded.
 - c. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user definable.
4. On-Line Help and Training
 - a. Provide a context sensitive, on line help system to assist the operator in operation and configuration of the system.
 - b. On-line help shall be available for all system functions and shall provide the relevant data for each particular screen.

5. Equipment and Application Pages

- a. The building operator web interface shall include standard pages for all equipment and applications. These pages shall allow an operator to obtain information relevant to the operation of the equipment and/or application, including:
 - 1) Animated Equipment Graphics for each major piece of equipment and floor plan in the System. This includes:
 - a) Each Chiller, Air Handler, VAV Terminal, Fan Coil, Boiler, and Cooling Tower. These graphics shall show all points dynamically as specified in the points list.
 - b) Animation capabilities shall include the ability to show a sequence of images reflecting the position of analog outputs, such as valve or damper positions. Graphics shall be capable of launching other web pages.
 - 2) Alarms relevant to the equipment or application without requiring a user to navigate to an alarm page and perform a filter.
 - 3) Historical Data (As defined in Trend Logs section of CONTROLLER SOFTWARE) for the equipment or application without requiring a user to navigate to a Data Log page and perform a filter.
- b. VAV Air System. An operator shall be able to view and control (where applicable) the following parameters via the building operator web interface:
 - 1) System Mode
 - 2) System Occupancy
 - 3) Ventilation (Outdoor air flow) setpoint
 - 4) Ventilation (Outdoor air flow) status
 - 5) Air Handler Static pressure setpoint
 - 6) Air Handler Static pressure status
 - 7) Air Handler occupancy status
 - 8) Air Handler Supply air cooling and heating set points
 - 9) Air Handler minimum, maximum and nominal static pressure setpoints
 - 10) VAV box minimum and maximum flow
 - 11) VAV box drive open and close overrides
 - 12) VAV box occupancy status
 - 13) VAV box Airflow to space
 - 14) Average space temperature
 - 15) Minimum space temperature
 - 16) Maximum space temperature

- 6. System Graphics. Building operator web interface shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system, and graphics that summarize conditions on each floor of each building area included in this contract. Indicate thermal comfort on floor plan summary graphics using colors to represent zone temperature relative to zone set point.
 - a. Graphic imagery – graphics shall use 3D images for all standard and custom graphics. The only allowable exceptions will be photo images, maps, schematic drawings, and selected floor plans.
 - b. Animation. Graphics shall be able to animate by displaying different Image lies for changed object status.
 - c. Alarm Indication. Indicate areas or equipment in an alarm condition using color or other visual indicator.

7. Graphics Library. Furnish a library of standard HVAC equipment such as chillers, air handlers, terminals, fan coils, unit ventilators, rooftop units, and VAV boxes, in 3-dimensional graphic depictions. The library shall be furnished in a file format compatible with the graphics generation package program.
8. Manual Control and Override
 - a. Point Control. Provide a method for a user to view, override, and edit if applicable, the status of any object and property in the system. The point status shall be available by menu, on graphics or through custom programs.
 - b. Temporary Overrides. The user shall be able to perform a temporary override wherever an override is allowed, automatically removing the override after a specified period of time.
 - c. Override Owners. The system shall convey to the user the owner of each override for all priorities that an override exists.
 - d. Provide a specific icon to show timed override or operator override, when a point, unit controller or application has been overridden manually.
9. Scheduling. - The scheduling application shall provide graphical representation of the day, week, month and exception events.
10. Alarm/Event Notification
 - a. Alarm/Event Log. The operator shall be able to view all logged system alarms/events from any building operator web interface.
 - 1) The operator shall be able to sort and filter alarms from events. Alarms shall be sorted in a minimum of 4 categories based on severity.
 - 2) The operator shall be able to acknowledge and add comments to alarms
 - 3) Alarm/event messages shall use full language, easily recognized descriptors.
 - b. Alarm Suppression. Alarms shall be able to be suppressed based on load/source relationships to present the likely root cause to the building operator as described in ASHRAE Guideline 36. Load/Source relationships shall be configurable by the user through a web interface.
11. Reports and Logs.
 - a. The building operator web interface shall provide a reporting package that allows the operator to select reports.
 - b. The building operator web interface shall provide the ability to schedule reports to run at specified intervals of time.
 - c. The following standard reports shall be available without requiring a user to manually configure the report:
 - 1) All Points in Alarm Report: Provide an on demand report showing all current alarms.
 - 2) All Points in Override Report: Provide an on demand report showing all overrides in effect.
 - 3) Commissioning Report: Provide a one-time report that lists all equipment with the unit configuration and present operation.
 - 4) Points report: Provide a report that lists the current value of all points
 - d. The controls vendor shall provide a hardening report that summarizes the port configuration details to ensure sites have not been exposed to the Internet in alignment with Cyber Security best practices.

B. Provide Mobile App Interface

1. Provide mobile (smart phone or tablet) interfaces to the building automation system, compatible with iOS and Android™ operating systems.
2. Controls manufacturer shall provide a phone/tablet interface with the ability to view/override status and setpoints, view/change schedules, view/acknowledge/comment on alarms, and view graphics for all spaces and equipment.
3. This phone/tablet interface shall resize itself appropriately for the size of the interface (i.e. no "pinching and zooming" required).
4. This phone/tablet interface shall function remotely from the facility while following IT security best practices (e.g. no ports exposed to the internet).
5. The operator interface shall support system access on a mobile device via a mobile app to:
 - a. Alarm log
 - b. System Status
 - c. Equipment status
 - d. Space Status
 - e. Standard Equipment graphics
 - f. Override set points
 - g. Override occupancy
 - h. Acknowledge Alarms
 - i. Add Comment(s) to Alarms

2.04 BUILDING CONTROLLER SOFTWARE

- A. Manufacturer shall provide standard applications to deliver HVAC system control. Standard applications include Time of Day Scheduling with Optimal Start/Stop, VAV Air Systems Control, Chiller Plant Control, Historical Trend Logs and Trim and Respond. Manufacturer shall provide system optimization strategies for functions such as fan pressure optimization and ventilation optimization.
- B. Furnish the following applications software for building and energy management. All software applications shall reside and run in the system controllers. Editing of applications shall occur at the building operator interface.
1. VAV Air Systems Applications
 - a. The BAS shall provide air system applications that coordinate air handlers (AHU)/rooftop units (RTU) and Variable Air Volume Terminal equipment.
 - b. The air system applications shall perform the following functions:
 - 1) Startup and shutdown the air handler safely. Ensure the VAV boxes are open sufficiently when the air handler is running, to prevent damage to the ductwork and VAV boxes due to high air pressure.
 - 2) Fan Pressure Optimization (ASHRAE 90.1, Guideline 36) - Minimize energy usage by controlling system static pressure to the lowest level while maintaining zone airflow requirements. Trim and respond reset logic shall reset setpoint within the range of min and max values based on zone requests.
 - 3) During commissioning, and with the engineer/owner, the controls contractor shall confirm the performance of Fan Pressure Optimization by conducting a field functional test that demonstrates critical zone reset.

- 4) Ventilation Optimization (ASHRAE 62) – properly ventilate all spaces while minimizing operating energy costs, using measured outdoor air flow. Dynamically calculate the system outdoor air requirement based on “real time” conditions in the spaces (i.e., number of occupants, CO2 levels, etc.) minimizing the amount of unconditioned outdoor air that must be brought into the building.
 - 5) Demand Controlled Ventilation – the active ventilation setpoint shall modulate between the occupied ventilation and occupied standby ventilation setpoint; Resetting the setpoint based on CO2 levels in the space.
 - 6) Discharge Air Temperature Reset (ASHRAE 90.1, Guideline 36) - Minimize energy usage by controlling discharge air temperature in response to building loads and outdoor air temperature. Trim and respond reset logic shall reset setpoint within the range of min and max values based on zone requests.
 - 7) If applicable mitigation sequences for A2L mildly flammable refrigerants, including BACnet COV (change of value) functionality and A2L Unoccupied Override to ensure rapid response and compliance with safety standards.
- c. The Air Systems application shall provide a user interface that includes status of current system operation with real time data of key operating parameters. Key operating parameters for Guideline 36 include:
- 1) Duct Static Pressure
 - 2) Duct Static Optimization Setpoint
 - 3) Outdoor Airflow
 - 4) Ventilation Optimization Setpoint
 - 5) Duct Static Optimization Maximum VAV Damper/Source VAV Box
 - 6) Ventilation Optimization Maximum VAV Vent Ratio/Source VAV box
 - 7) Discharge Air Temperature
 - 8) Discharge Air Temperature Optimization Setpoint
 - 9) Duct Static Optimization System Requests
 - 10) Discharge Air Temperature Optimization System Requests
- d. The air system application status screens shall explain what optimization calculations are occurring, critical parameters, and source equipment members. The optimization status, inputs, and results shall be displayed for VAV Ventilation Optimization (calculating proper outside air intake), VAV Discharge Air Temperature Optimization (calculating proper discharge air temperature) and VAV Duct Static Pressure Optimization (calculating proper fan static pressure).
- e. The air systems applications shall provide a user interface that enables configuration changes made by swipe and type fields, selection list, and check box entry for feature definition:
- 1) VAV Auxiliary Night Heat
 - 2) VAV Source Temperature Distribution
 - 3) Changeover System control
 - 4) Start/Stop Delay operation
 - 5) Enable/Disable Optimization Strategies (Duct Static Optimization, Discharge Air Temperature Optimization and Ventilation Optimization)
- f. The operation of VAV Terminal equipment members of the VAV Air System shall be selected by check box to optionally participate in the following functions when for Guideline 36 applications:
- 1) System calculations (min, max, average)
 - 2) Duct Pressure Optimization
 - 3) Ventilation Optimization

- 4) Drive to Maximum Override
 - 5) Common Source Temperature
 - 6) Common Space
 - 7) Discharge Air Temperature Optimization
 - 8) Hot Water Temperature Optimization
 - 9) Chilled Water Temperature Optimization
 - g. The air system application vendor shall provide a published applications guide that details the air system application operation, configuration, setup, and troubleshooting. The applications guide documentation shall be maintained under version control, and updated by the manufacture to reflect most recent feature updates as made available. Contents of the guide shall include:
 - 1) Description of System Operation
 - 2) Required Components
 - 3) Sequences of Operation
 - 4) Installation
 - 5) Controller Setup
 - 6) Required Programming
 - 7) Commissioning
 - 8) Optimization Strategies
 - 9) Special Applications
 - 10) Troubleshooting
 - h. The air system application shall present in plain user language the current operation with source zone information and reset events.
2. Trend Logs
- a. The system shall harvest trend logs for defined key measurements for each controlled HVAC device and HVAC application. Trend logs shall be captured for a minimum of 5 key operating points for each piece of HVAC equipment and HVAC application and stored for no less than 1 year at 15-minute intervals. Data Logs shall be capable of being configured on an interval or change of value basis.
 - 1) Fan Coil
 - a) Discharge Air Temperature
 - b) Space Temperature Active
 - c) Space Temperature Setpoint Active
 - d) Air Flow Setpoint Active
 - e) Discharge Air Flow
 - 2) Air Handling Unit/Rooftop (VAV)
 - a) Discharge Air Temperature
 - b) Discharge Air Temperature Setpoint Active
 - c) Space Temperature Active
 - d) Cooling Capacity Status
 - e) Discharge Air Flow
 - 3) Air Handling Unit/Rooftop (CV)
 - a) Discharge Air Temperature
 - b) Space Temperature Active

- c) Space Temperature Setpoint Active
 - d) Cooling Capacity Status
 - e) Heating Capacity Primary Status
 - f) Outdoor Air Damper Position
- 4) VAV Box
 - a) Discharge Air Temperature
 - b) Space Temperature Active
 - c) Space Temperature Setpoint Active
 - d) Air Flow Setpoint Active
 - e) Discharge Air Flow
- 3. Trim and Respond
 - a. The BAS shall provide a setpoint reset application program based on 'trim and respond' functionality as outlined in ASHRAE Guideline 36.

2.05 DDC EQUIPMENT

- A. Control Units: Modular easy expansion, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.
 - 1. Connectivity: Supports BACnet, Modbus, LonWorks, and multiple protocols, and has built-in WiFi and ethernet capabilities.
- B. Building / System Controllers:
 - 1. There shall be one or more independent, standalone microprocessor based System Controllers to manage the global strategies described in CONTROLLER SOFTWARE section.
 - a. The controller shall provide a USB communications port for connection to a PC.
 - b. The operating system of the Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.
 - c. All System Controllers shall have a real time clock and shall be able to accept a BACnet time synchronization command for automatic time synchronization.
 - d. Data shall be shared between networked System Controllers.
 - e. Serviceability – The System Controller shall have a display on the main board that indicates the current operating mode of the controller.
 - 2. Controls manufacturer shall provide secure remote access to the Building Automation System (BAS). Secure remote access shall not require IP ports to be "exposed" (i.e. port-forwarded or external public IP addresses) to the Internet. Controls manufacturer shall update secure remote access software as necessary to follow cyber security best practices and respond to cyber security events.
- C. Advanced Application Controllers:
 - 1. Advance Application Controllers shall be used to control all equipment or applications of medium and high complexity, including but not limited to Air Handlers, Boiler Plants and Chiller Plants.

2. The Advanced Application Controller shall be capable of operating as a stand-alone controller or as a member of a Building Automation System (BAS).
3. When the Advanced Application Controller is operating as a member of a Building Automation System (BAS), the application controller shall operate as follows:
 - a. Application Controller will receive operation mode commands from the BAS network controller. The BAS commands shall include but not be limited to the follow: Occupied Heat/Cool, Unoccupied Heat/Cool, Morning Warm-up, / Pre-cool, Occupied Bypass).
 - b. Application Controller will provide equipment status parameters to the BAS through BACnet communication.
 - c. Application Controller will operate as a stand-alone controller in the event of communication failure with the BAS.
 - d. In case of communications failure, stand-alone operation shall use default values or last known values for remote sensors read over the network such as outdoor air temperature.
4. For Stand-Alone Operation of Advanced Application Controllers:
 - a. Shall operate a schedule in a standalone application using a Real Time Clock with a 7 day power backup.
 - 1) The Controller shall have a built in schedule (assessable with or without a display)
 - 2) Support will be for at least 3 schedules with up to 10 events for each day of the week.
 - 3) Each of the 3 schedules can be Analog, Binary or Multi-State
 - 4) The controller shall support a minimum of 25 exceptions each with up to 10 events.
5. For ease of troubleshooting, the Controller shall support data trend logging.
 - a. With a minimum of 20,000 trending points total on a controller
 - b. Trends shall be capable of being collected at a minimum sample rate of once every second
 - c. Shall be capable of trending all BACnet points used by controller
 - d. Trends shall be capable of being scheduled or triggered.
6. To meet the sequence of operation for each application, the Controller shall use library programs provided by the controller manufacturer that are either factory loaded or downloaded with service tool to the controller.
7. Environment. Controller hardware shall be suitable for the anticipated ambient conditions.
 - a. Operating conditions:
 - 1) Temperature: -40°F to 158°F (-40°C to 70°C)
 - 2) Relative Humidity: 5% to 100% RH (non-condensing)
 - b. Controllers used indoors shall be mounted in a NEMA 1 enclosure at a minimum.
 - c. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40° F to 158° F [-40° C to 70° C].
8. Input/Output: The Controller shall have on board or through expansion module all I/O capable of performing all functionality needed for the application. Controls provided by the

equipment manufacture must supply the required I/O for the equipment. In addition other controls must meet the following requirements:

- a. Shall support flexibility in valve type, the controllers shall be capable of supporting the following valve control types: 0-10VDC, 0-5VDC, 4-20mA, 24VAC - 2 position.
 - b. Shall support flexibility in sensor type, the Controller shall be capable of reading sensor input ranges of 0 to10V, 0 to 20mA, 50ms or longer pulses, 200 to 20Kohm and RTD input.
 - c. Shall support flexibility in sensor type, all Analog Outputs shall have the additional capability of being programmed to operate as Universal Inputs or Pulse Width Modulation Outputs.
 - d. Shall support flexibility in sensor type, the Controller and/or expansion modules shall support dry and wetted (24VAC) binary inputs.
 - e. The controller shall support pulse accumulator for connecting devices like energy meters.
 - f. In order to support a wide range of devices, the Controller's binary output shall be able to drive at least 10VA each.
 - g. For future needs, any unused I/O that is not needed for the functionality of the equipment shall be available to be used by custom programs on the Controller and by any other controller on the network.
 - h. The Controller shall provide 24VAC and 24VDC power terminals sensors and other devices required.
 - i. The Controller shall provide a dedicated static pressure input.
9. Input/Output Expandability – The Controller shall provide the following functionality in order to meet current and future application needs:
- a. For the application flexibility, the Controller shall be capable of expanding to a total of at least 100 hardware I/O terminations.
 - b. Expansion I/O can be mounted up to 650 ft. (200m) from control.
 - c. For optimized system operation, expansion I/O must communicate via an internal controller communication bus (point expansion via the BACnet MS/TP network is not allowed).
10. Serviceability – The Controller shall provide the following in order to improve serviceability of the Controller.
- a. Diagnostic LEDs for power/normal operation/status, BACnet communications, sensor bus communications, and binary outputs. All wiring connections shall be clearly labeled and made to be field removable.
 - b. Binary and analog inputs and outputs shall use removable connectors or be connected to terminal strip external to the control box.
 - c. Software service tool connection through the following methods: direct cable connection to the Controller, connection through another controller on BACnet link
 - d. For safety purposes, the controller shall be capable of being powered by a portable computer's USB port for the purposes of configuration, programming and testing programs so that this work can be accomplished with the power off to the associated equipment.
 - e. The Controller software tool service port shall utilize standard off-the-shelf USB printer cable.
 - f. Capabilities to temporarily override the BACnet point values with built-in time expiration in the Controller.
 - g. To aid in service replacement, the Controller shall easily attached to standard DIN rail mounting.

- h. For future expansion, the Controller shall be capable of adding sequence of operation programming utilizing service tools software with a graphical programming interface (editing or programming in line code is not permissible).
 - i. To aid in service replacement, the Controller shall allow for setting its BACnet address via controller mounted rotary switches that correspond to the numerical value of the address. (DIP switch methodologies are not allowed). Setting of the address shall be accomplished without the need of a service tool or power applied to the controller.
 - j. Controller data shall be maintained through a power failure.
- 11. Software Retention: All Controller operating parameters, setpoints, BIOS, and sequence of operation code must be stored in non-volatile memory in order to maintain such information for months without power.
- 12. Controller must meet the following Agency Compliance:
 - a. UL916 PAZX, Open Energy Management Equipment
 - b. UL94-5V, Flammability
 - c. FCC Part 15, Subpart B, Class B Limit
 - d. BACnet Testing Laboratory (BTL) listed as BACnet Advanced Application Controller (B-AAC)

D. Application Specific Controllers:

1. General Description

- a. Application Specific Controllers (ASC) shall be microprocessor-based DDC controllers which, through hardware or firmware design, control specified equipment. They are not user programmable, but are customized for operation within the confines of the equipment they are designed to serve.
 - b. Zone Controllers are controllers that operate equipment that control the space temperature of single zone. Examples are controllers for VAV, Fan coil, Blower Coils, Unit Ventilators, Heat Pumps, and Water Source Heat Pumps.
- 2. The Application Specific Controller shall be capable of operating as a stand-alone controller or as a member of a Building Automation System (BAS).
- 3. When the Application Specific Controller is operating as a member of a Building Automation System (BAS), the application controller shall operate as follows:
 - a. Application Controller will receive operation mode commands from the BAS network controller. The BAS commands shall include but not be limited to the follow: Occupied Heat/Cool, Unoccupied Heat/Cool, Morning Warm-up, / Pre-cool, Occupied Bypass).
 - b. Application Controller will provide equipment status parameters to the BAS through BACnet communication.
 - c. Application Controller will operate as a stand-alone controller in the event of communication failure with the BAS.
 - d. In case of communications failure stand-alone operation shall use default values or last known values for remote sensors read over the network such as outdoor air temperature.
- 4. Stand-Alone Operation: Each piece of equipment specified in section "A" shall be controlled by a single controller and provide stand-alone control in the event that a BAS is not present.
- 5. Software

- a. To meet the sequence of operation for each zone control, the controller shall use programs developed and tested by the controller manufacturer that are either factory loaded or downloaded with service tool to the controller.
 - b. For controlling ancillary devices and for flexibility to change the sequence of operation in the future, the controller shall be capable running custom programs written in a graphical programming language.
6. Environment: Controller hardware shall be suitable for the anticipated ambient conditions.
 - a. Storage: -55° to 203° F and 5 to 95% Rh, non-condensing.
 - b. Operating: -40° to 158° F and 5 to 95% Rh, non-condensing.
 - c. Controllers used indoors shall be mounted in a NEMA 1 enclosure at a minimum.
 - d. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40° to 158° F.
7. Input/Output:
 - a. For flexibility in selection and replacement of valves, the controllers shall be capable of supporting all of the following valve control types 0-10VDC, 0-5VDC, 4-20mA, 24VAC floating point, 24VAC - 2 position (Normally Open or Normally Closed).
 - b. For flexibility in selection and replacement of sensors, the controllers shall be capable of reading sensor input ranges of 0 to 10V, 0 to 20mA, pulse counts, and 200 to 20Kohm.
 - c. For flexibility in selection and replacement of binary devices, the controller shall support dry and wetted (24VAC) binary inputs.
 - d. For flexibility in selection and replacement devices, the controller's shall have binary output which are able to drive at least 12VA each.
 - e. For flexibility in selection and replacement of motors, the controller shall be capable of outputting 24VAC (binary output), DC voltage (0 to 10VDC minimum range) and PWM (in the 80 to 100 Hz range).
 - f. For future needs, any I/O that is unused by functionality of equipment control shall be available to be used by custom program on the controller and by another controller on the network.
 - g. For future expansion and flexibility, the controller shall have either on board or through expansion, 20 hardware input/output points. Expansion points must communicate with the controller via an internal communications bus. Expansion points must be capable of being mounted up to 650ft. (200 m) from the controller. Expansion points that require the BACnet network for communication with the controller are not allowed.
8. Serviceability – The controller shall provide the following in order to improve serviceability of the controller.
 - a. Diagnostic LEDs shall indicate correct operation or failures/faults for all of the following: power, sensors, BACnet communications, and I/O communications bus.
 - b. All binary output shall have LED's indicating the output state.
 - c. All wiring connectors shall removable without the use of a tool.
 - d. Software service tool connection through all of the following methods: direct cable connection to the controller, connection through another controller on BACnet link
 - e. For safety purposes, the controller shall be capable of being powered by a portable computer for the purposes of configuration, programming, and testing programs so that this work can be accomplished with the power off to the equipment.
 - f. Capabilities to temporarily override of BACnet point values with built-in time expiration in the controller.
 - g. BACnet MAC Address shall be set using decimal (0-9) based rotary switches.

- 1) Configuration change shall not be made in a programming environment, but rather by a configuration page utilizing dropdown list, check boxes, and numeric boxes.
- h. For ease of troubleshooting, the Controller shall support BACnet data trend logging.
 - 1) With a minimum of 20,000 trending points total on controller
 - 2) Trends shall be capable of being collected at a minimum sample rate of once every second.
 - 3) Shall be capable of trending all BACnet points used by controller
 - 4) Trends shall be capable of being scheduled or triggered
9. Software Retention: All Zone Controller operating parameters, setpoints, BIOS, and sequence of operation code must be stored in non-volatile memory in order to maintain such information for months without power.
10. Application controller shall meet the following Agency Compliance:
 - a. UL916 PAZX, Open Energy Management Equipment
 - b. UL94-5V, Flammability
 - c. FCC Part 15, Subpart B, Class B Limit
 - d. BACnet Testing Laboratory (BTL) listed as BACnet Application Specific Controller (B-ASC)
- E. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
- F. Variable Air Volume Terminal Unit Controllers:
 1. General Description
 - a. Variable Air Volume (VAV) controllers shall be microprocessor-based DDC controllers which, through hardware or firmware design, control specified equipment. They are typically not user programmable, but are configurable for operation of VAV terminal units.
 - b. Variable Air Volume (VAV) controllers are controllers that operate equipment that control the space temperature of single zone.
 2. The VAV controller shall be capable of operating as a stand-alone controller or as a member of a Building Automation System (BAS).
 3. When the VAV controller is operating as a member of a Building Automation System (BAS), the application controller shall operate as follows:
 - a. The VAV controller will receive operation mode commands from the BAS network controller. The BAS commands shall include but not be limited to the following: Occupied Heat/Cool, Unoccupied Heat/Cool, Morning Warm-up, / Pre-cool, Occupied Bypass).
 - b. The VAV controller will provide equipment status parameters to the BAS through BACnet communication.
 - c. The VAV controller will operate as a stand-alone controller in the event of communication failure with the BAS.
 - d. In case of communications failure stand-alone operation shall use default values or last known values for remote sensors read over the network such as outdoor air temperature.

4. Stand-Alone Operation: Each VAV Terminal Unit shall be controlled by a single controller and provide stand-alone control in the event that a BAS is not present.
5. The VAV controller shall communicate to the building automation system via one of the following protocols: BACnet™ MS/TP, BACnet™ Zigbee or BACnet™ IP as defined in ANSI®/ASHRAE® Standard 135-2020.
 - a. BACnet™ MS/TP
 - 1) To allow maximum communications speed and co-existence with other controllers, the controller shall support at a minimum the following BACnet MS/TP manager baud rates: 9600, 19200, 38400, 76800.
 - b. BACnet™ IP
 - 1) BACnet IP controllers provide BACnet communications over Internet Protocol via Local Area Networks (LAN), an open standard building automation communication protocol that enables connections to other building automation systems and controllers.
 - c. BACnet™ Zigbee
 - 1) VAV controller wireless communication interface shall self-form and self-heal to maintain operation in the event of network communication failure.
 - 2) IEEE 802.15.4 radios to minimize risk of interference, reliability, and range.
 - 3) Operating range shall be a minimum of 200 feet; open range shall be 2,500 ft. (762 m) with less than 2% packet error rate.
 - 4) To protect against harmful interference, certifications shall include Energy Management Equipment FCC CFR47, Section 15.247 & subpart E, Digital Modulation Transmission with no SAR (FCC ID: TPF-251701)
6. Each VAV terminal unit shall use a space zone sensor(s) to measure the space condition it is serving.
 - a. The VAV controller shall use a wired or wireless communication interface to connect to its space zone sensor.
 - b. Each zone sensor communication interface shall be capable of many-to-one sensors per controller to support averaging, monitoring, and multiple zone applications. Sensing options shall include temperature, relative humidity, CO2, and occupancy.
 - c. Wireless zone sensors
 - 1) To check for proper operation, wireless zone temperature sensors shall include a signal strength and battery condition indicators on the zone sensor.
 - 2) The wireless zone sensor battery life shall provide at least 15 years life under normal operating conditions and must be readily available Lithium size AA, 1.5V.
 - 3) The wireless zone sensor and receiver addresses shall be held in non-volatile memory to ensure operation through system voltage disturbances and to minimize the risk of incorrect association.
 - 4) To ensure proper system performance, the wireless zone sensor shall automatically determine when the space temperature is rapidly changing. When the space temperature is readily changing, the space temperature shall be transmitted at least once each 30 seconds. The maximum time between transmissions shall be 15 minutes.
 - 5) Zone temperature sensing accuracy shall be +/- 0.5F (+/- 0.28C).

7. Software
 - a. To meet the sequence of operation for each zone control, the controller shall use programs developed and tested by the controller manufacturer that are either factory loaded or downloaded with service tool to the controller.
 - b. For controlling ancillary devices and for flexibility to change the sequence of operation in the future, the controller shall be capable running custom programs written in a graphical programming language.
8. Environment: Controller hardware shall be suitable for the anticipated ambient conditions.
 - a. Storage: -55° to 203° F and 5 to 95% Rh, non-condensing.
 - b. Operating: -40° to 158° F and 5 to 95% Rh, non-condensing.
 - c. Controllers used indoors shall be mounted in a NEMA 1 enclosure at a minimum.
 - d. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40° to 158° F.
9. Input/Output:
 - a. For flexibility in selection and replacement of valves, the controllers shall be capable of supporting all of the following valve control types 0-10VDC, 0-5VDC, 4-20mA, 24VAC floating point, 24VAC - 2 position (Normally Open or Normally Closed).
 - b. For flexibility in selection and replacement of sensors, the controllers shall be capable of reading sensor input ranges of 0 to 10V, 0 to 20mA, and 200 to 20Kohm.
 - c. For flexibility in selection and replacement of binary devices, the controller shall support dry and wetted (24VAC) binary inputs.
 - d. For flexibility in selection and replacement devices, the controller shall have binary output which are able to drive at least 12VA each.
 - e. For flexibility in selection and replacement of motors, the controller shall be capable of outputting 24VAC (binary output), DC voltage (0 to 10VDC minimum range) and PWM (in the 80 to 100 Hz range).
10. Serviceability – The controller shall provide the following in order to improve serviceability of the controller.
 - a. Diagnostic LEDs shall indicate correct operation or failures/faults for all of the following: power, sensors, BACnet communications, and I/O communications bus.
 - b. All binary output shall have LED's indicating the output state.
 - c. All wiring connectors shall removable without the use of a tool.
 - d. Software service tool connection through all of the following methods: direct cable connection to the controller, connection through another controller on BACnet link and through the controller's zone sensor.
 - e. For safety purposes, the controller shall be capable of being powered by a portable computer for the purposes of configuration, programming, and testing programs so that this work can be accomplished with the power off to the equipment.
 - f. Capabilities to temporarily override of BACnet point values with built-in time expiration in the controller.
 - g. BACnet MAC Address shall be set using decimal (0-9) based rotary switches.
 - 1) Configuration change shall not be made in a programming environment, but rather by a configuration page utilizing dropdown list, check boxes, and numeric boxes.
 - h. For ease of troubleshooting, the Controller shall support BACnet data trend logging.

- 1) Trends shall be capable of being collected at a minimum sample rate of once every second.
 - 2) Shall be capable of trending all BACnet points used by controller
 - 3) Trends shall be capable of being scheduled or triggered
11. Software Retention: All Zone Controller operating parameters, setpoints, BIOS, and sequence of operation code must be stored in non-volatile memory in order to maintain such information for months without power.
12. Controller shall meet the following Agency Compliance:
- a. UL916 PAZX, Open Energy Management Equipment
 - b. UL94-5V, Flammability
 - c. FCC Part 15, Subpart B, Class B Limit
 - d. AS/NZS CISPR 32:2016
 - e. VCCI-CSPR 32:2016
 - f. CAN ICES-003(B)/NMB-003(B)
 - g. To ensure integration to the building automation system the controller must be BTL (BACnet Testing Lab) listed. The following BACnet profiles are in order of most functionality (B-BC) to least functionality (B-ASC).
- 1) BACnet Building Controller (B-BC)
 - 2) BACnet Advance Applications Controller (B-AAC)
 - 3) BACnet Application Specific Controller (B-ASC)

G. Input/Output Interface:

1. Hardwired inputs and outputs may tie into the system through building, custom application, or ASCs.
2. All input points and output points shall be protected such that shorting of the point to itself, to another point, or to ground will cause no damage to the controller. All input and output points shall be protected from voltage up to 24V of any duration, such that contact with this voltage will cause no damage to the controller.
3. Binary inputs shall allow the monitoring of on/off signals from remote devices. The binary inputs shall provide a wetting current of at least 12 mA to be compatible with commonly available control devices and shall be protected against the effects of contact bounce and noise. Binary inputs shall sense "dry contact" closure without external power (other than that provided by the controller) being applied.
4. Pulse accumulation input objects. This type of object shall conform to all the requirements of binary input objects and also accept up to 10 pulses per second for pulse accumulation.
5. Analog inputs shall allow the monitoring of low voltage (0 to 10 VDC), current (4 to 20 mA), or resistance signals (thermistor, RTD). Analog inputs shall be compatible with and field configurable to commonly available sensing devices.
6. Binary outputs shall provide for on/off operation or a pulsed low-voltage signal for pulse width modulation control. Binary outputs on building and custom application controllers shall have status lights. Outputs shall be selectable for either normally open or normally closed operation.
7. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0 to 10VDC or a 4 to 20 mA signal as required to provide proper control of the output device. Analog outputs shall not exhibit a drift of greater than 0.4% of range per year.
8. Tri-State Outputs. Provide tri-state outputs (two coordinated binary outputs) for control of three-point floating type electronic actuators without feedback. Use of three-point floating devices shall be limited to zone control and terminal unit control applications (VAV terminal units, duct-mounted heating coils, zone dampers, radiation, etc.). Control algorithms shall run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.

9. System Object Capacity. The system size shall be expandable to at least twice the number of input/ output objects required for this project. Additional controllers (along with associated devices and wiring) shall be all that is necessary to achieve this capacity requirement. The operator interfaces installed for this project shall not require any hardware additions or software revisions in order to expand the system.
- H. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity.
 1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in overvoltage and overcurrent protection and shall be able to withstand a 150% current overload for at least three seconds without trip-out or failure.
 - a. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MIL-STD 810C for shock and vibration.
 - b. Line voltage units shall be UL recognized and CSA approved.
- I. System shall be capable of being integrated with larger system with graphics (for future).

2.06 SENSING DEVICES

- A. Temperature Sensor Details
 1. Duct Probe Type: Ensure the probe is long enough to properly sense the air stream temperature.
 2. Duct Averaging Type: Continuous averaging sensors shall be one foot in length for each 4 square feet of duct cross-sectional area, and a minimum length of 6 ft.
 3. Pipe Immersion Type: Provide minimum three-inch immersion. Provide each sensor with a corresponding pipe-mounted sensor well, unless indicated otherwise. Sensor wells shall be stainless steel when used in steel piping, and brass when used in copper piping. Provide the sensor well with a heat-sensitive transfer agent between the sensor and the well interior.
 4. Outside Air Type: Provide the sensing element on the building's north side with a protective weather shade that positions the sensor approximately 3 inches off the wall surface, does not inhibit free air flow across the sensing element, and protects the sensor from snow, ice, and rain.
- B. Transmitters: Provide transmitters with 4 to 20 mA or 0 to 10 VDC linear output scaled to the sensed input. Transmitters shall be matched to the respective sensor, factory calibrated, and sealed. Size transmitters for an output near 50 percent of its full-scale range at normal operating conditions. The total transmitter error shall not exceed 0.1 percent at any point across the measured span. Supply voltage shall be 12 to 24 volts AC or DC. Transmitters shall have non-interactive offset and span adjustments. For temperature sensing, transmitter drift shall not exceed 0.03 degrees F a year.
- C. Relative Humidity Transmitters: Provide transmitters with an accuracy equal to plus or minus 3 percent from 0 to 90% scale, and less than one percent drift per year. Sensing elements shall be the polymer type. Vaisala Model HMD50U or equal.
- D. Freeze Protection Thermostats: Provide special purpose thermostats with flexible capillary elements 20 feet minimum length for coil face areas up to 40 square feet. Provide longer elements for larger coils at 1-foot of element for every 4 square feet of coil face area, or provide additional

thermostats. Provide switch contacts rated for the respective motor starter's control circuit voltage. Include auxiliary contacts for the switch's status condition. A freezing condition at any 18-inch increment along the sensing element's length shall activate the switch. The thermostat shall be equipped with a manual push-button reset switch so that when tripped, the thermostat requires manual resetting before the HVAC equipment can restart.

2.07 OUTPUT HARDWARE

- A. Motorized control dampers, unless otherwise specified elsewhere, shall be as follows:
1. Submittals shall include leakage, maximum airflow and maximum pressure ratings based on AMCA Publication 500. Dampers shall meet the leakage requirements of the International Energy Conservation Code by leaking less than 3 cfm/sq. ft. at 1" of static pressure and shall be AMCA licensed as Class 1A. Dampers shall be Ruskin model CD60, or approved equal.
 2. Control dampers shall be the parallel or opposed blade type as follows: Outdoor and/or return air mixing dampers shall be parallel blade, arranged to direct airstreams toward each other. Other modulating dampers shall be the opposed blade type. Two-position shutoff dampers may be parallel or opposed blade type with blade and side seals.
 3. Frame: 5 inches x minimum 16 gage roll formed, galvanized steel hat-shaped channel, reinforced at corners. Structurally equivalent to 13 gage U-channel. Damper blades shall not exceed 8 inches in width or 48 inches in length. Blades shall be suitable for medium velocity performance 2000 fpm. Blades shall be not less than 16-gauge.
 4. Bearings shall be corrosion resistant, permanently lubricated stainless steel sleeve type turning in an extruded hole in the damper frame.
 5. All blade edges, top, and bottom of the frame shall be provided with replaceable butyl rubber or neoprene seals. Side seals shall be spring-loaded stainless steel.
 6. Individual damper sections shall not be larger than 48 in. x 60 in. Provide a minimum of one damper actuator per section.
 7. Modulating dampers shall provide a linear flow characteristic where possible.
 8. Dampers shall have exposed linkages. Dampers over 48" in applications where sectioning is not applicable shall be supplied with a jackshaft to provide sufficient force throughout the intended operating range.
- B. Electronic damper/valve actuation shall be provided.
1. Manufactured, brand labeled or distributed by BELIMO, or approved equal.
 2. Size for torque required for damper seal at load conditions.
 3. Coupling: V-bolt dual nut clamp with a V-shaped, toothed cradle.
 4. Mounting: Actuators shall be capable of being mechanically and electrically paralleled to increase torque if required.
 5. Overload protected electronically throughout rotation.
 6. Fail-Safe Operation: Mechanical, spring-return mechanism.
 7. Manual Positioning. Operators shall be able to manually position each actuator when the actuator is not powered. Non-spring-return actuators shall have an external manual gear release. Spring-return actuators with more than 60 in.-lb. torque capacity shall have a manual crank.
 8. Proportional Actuators shall be fully programmable through an EEPROM without the use of actuator mounted switches.
 9. Proportional actuators shall have an external, built-in switch to allow the reversing of direction of rotation.
 10. Proportional actuators shall accept a 0 to 10 VDC or 0 to 20 mA control signal and provide a 2 to 10 VDC or 4 to 20 mA operating range. An actuator capable of accepting a pulse width modulating control signal and providing full proportional operation of the damper is acceptable. All actuators shall provide a 2 to 10 VDC position feedback signal.

11. Temperature Rating: -22 to +122°F -30 to +50°C [-58 to +122°F -50 to +50°C]
 12. Housing: Minimum requirement NEMA type 2 mounted in any orientation. .
 13. Agency Listings: ISO 9001, cULus, CE or CSA
 14. The manufacturer shall warrant all components for a period of 5 years from the date of production, with the first two years unconditional.
- C. Control Valves: Control valves shall be two-way or three-way type for two-position or modulating service as shown.
1. Close-off (differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings:
 - a. Two-way: 150% of total system (pump) head.
 - b. Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.
 2. Water Valves: Body and trim style and materials shall be in accordance with manufacturer's recommendations for design conditions and service shown, with equal percentage ports for modulating service.
 - a. Sizing Criteria:
 - 1) Two-position service: Line size.
 - 2) Two-way modulating service: Pressure drop shall be equal to twice the pressure drop through heat exchanger (load), 50% of the pressure difference between supply and return mains, or 5 psi, whichever is greater.
 - 3) Three-way modulating service: Pressure drop equal to twice the pressure drop through the coil exchanger (load), 5 psi maximum.
 - b. Valves ½ in. through 2 in. shall be bronze body or cast brass ANSI Class 250, spring-loaded, PTFE packing, quick opening for two-position service. Two-way valves to have replaceable composition disc or stainless steel ball.
 - c. Water valves shall fail normally open or closed, as specified.
- D. Output Switches: Control Relays; Relays shall be double pole, double throw, UL864 listed, with contacts rated for the intended application, indicator light, and dust proof enclosure. The indicator light shall be lit when the coil is energized and off when coil is not energized. Relays shall be the socket type, plug into a fixed base, and replaceable without tools or removing wiring. Encapsulated "PAM" type relays may be used for terminal control applications.

2.08 STATUS SENSORS

- A. Status Inputs for Electric Motors: Veris Hawkeye 908 Series, or approved equal; split-core adjustable current sensors designed to provide accurate, reliable and maintenance-free fan and pump status indication. Comply with ISA 50.00.01, current-sensing split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.
- B. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.
- C. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.

2.09 ELECTRICAL POWER AND DISTRIBUTION

- A. Provide per Division 26.
- B. Wiring And Raceways:
 - 1. General: Provide copper wiring, plenum cable, and raceways as specified in the applicable sections of this specification.
 - 2. All insulated wire to be copper conductors, UL labeled for 90°C (194°F) minimum service.
 - 3. Fiber Optic Cable. Optical cables shall be duplex 900 mm tight-buffer construction designed for intra-building environments. The sheath shall be UL Listed OFNP in accordance with NEC Article 770. The optical fiber shall meet the requirements of FDDI, ANSI X3T9.5 PMD for 62.5/125 µm.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. The project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the architect/engineer for resolution before rough-in work is started.
- B. The contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the engineer for resolution before rough-in work is started. Verify that duct-, pipe-, and equipment-mounted devices and wiring are installed before proceeding with installation.
- C. The contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate—or if any discrepancies occur between the plans and the contractor's work or others—the contractor shall report these discrepancies to the engineer and shall obtain written instructions for any changes necessary to accommodate the contractor's work with the work of others. Any changes in the work covered by this specification made necessary by the failure or neglect of the contractor to report such discrepancies shall be made by—and the expense of—this contractor.

3.02 INSTALLATION

- A. Provide all components in accordance with the manufacturer's recommendations. Perform the installation under the supervision of competent technicians regularly employed in the installation of similar control systems.
- B. Provide equipment, piping, and wiring/raceway parallel to building lines (i.e., horizontal, vertical, and parallel to walls) wherever possible.
- C. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
- D. All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices. Contractor shall continually monitor the field installation for code compliance and quality of workmanship. Contractor shall have work inspected by local and/or state authorities having jurisdiction over the work.

- E. Temperature Sensors: Provide temperature sensors in locations that are accessible and provide a good representation of sensed media. Installations in dead spaces are not acceptable. Calibrate sensors according to manufacturer's instructions. Do not use sensors designed for one application in a different application.
- F. Room Temperature Sensors: Verify location of thermostats and other exposed control sensors with plans and room details before installation. Mount the sensors on interior walls to sense the average room temperature at the locations indicated. Avoid locations near heat sources such as copy machines or locations by supply air outlet drafts. Mount the center of the sensor 48 inches above the floor to meet ADA requirements.
- G. Duct Temperature Sensors
 - 1. Probe Type: Provide a gasket between the sensor housing and the duct wall. Seal the duct penetration air tight. Seal the duct insulation penetration vapor tight.
 - 2. Averaging Type (and coil freeze protection thermostats): Weave the capillary tube sensing element in a serpentine fashion perpendicular to the flow, across the duct or air handler cross-section, using durable non-metal supports. Prevent contact between the capillary and the duct or air handler internals. Provide a duct access door at the sensor location. The access door shall be hinged on the side, factory insulated, have cam type locks, and be as large as the duct will permit; maximum 18 x 18 inches. For sensors inside air handlers, the sensors shall be fully accessible through the air handler's access doors without removing any of the air handler's internals.
- H. Outside Air Temperature Sensors: Provide outside air temperature sensors in weatherproof enclosures on the north side of the building, away from exhaust hoods and other areas that may affect the reading. Provide a shield to shade the sensor from direct sunlight.
- I. Gas Monitor/Transmitters: Verify location of transmitter with room layout and details before installation. Do not exceed the manufactures' recommended maximum surveillance radius. Provide proper quantity as required. Mounting height shall be at manufacturer recommended height for the gas being sensed.

3.03 WIRING

- A. All control and interlock wiring shall comply with national and local electrical codes, and Division 26 of this specification.
- B. Communication Wiring:
 - 1. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling.
 - 2. Do not install communication wiring in raceway and enclosures containing Class 1 or other Class 2 wiring.
 - 3. Maximum pulling, tension, and bend radius for cable installation, as specified by the cable manufacturer shall not be exceeded during installation.
 - 4. Contractor shall verify the integrity of the entire network following cable installation. Use appropriate test measures for each particular cable.
 - 5. When a cable enters or exits a building, a lightning arrestor must be installed between the line and ground.
 - 6. All runs of communication wiring shall be unspliced length when the length is commercially available.
 - 7. All communication wiring shall be labeled to indicate origin and destination.

3.04 FIBER OPTIC CABLE

- A. All cabling shall be installed in a neat and workmanlike manner. Minimum cable and unjacketed fiber bend radii as specified by cable manufacturer shall be maintained.
- B. Maximum pulling tensions as specified by the cable manufacturer shall not be exceeded during installation. Post installation residual cable tension shall be within cable manufacturer's specifications.
- C. Fiber optic cabinets, hardware, and cable entering the cabinet shall be installed in accordance with manufacturers' instructions. Minimum cable and unjacketed fiber bend radii as specified by cable manufacturer shall be maintained.

3.05 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
 - 2. Test and adjust controls and safeties.
 - 3. Test calibration of controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
 - 4. Test each point through its full operating range to verify that safety and operating control set points are as required.
 - 5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
 - 6. Test each system for compliance with sequence of operation.
 - 7. Test software and hardware interlocks.
- B. Verification:
 - 1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
 - 2. Check temperature instruments and material and length of sensing elements.
 - 3. Check control valves. Verify that they are in correct direction.
- C. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.06 ADJUSTING

- A. Calibrating and Adjusting:
 - 1. Calibrate instruments.
 - 2. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
 - 3. Control System Inputs and Outputs:
 - a. Check analog inputs at 0, 50, and 100 percent of span.
 - b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
 - c. Check digital inputs using jumper wire.
 - d. Check digital outputs using ohmmeter to test for contact making or breaking.

- e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
- 4. Temperature:
 - a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
 - b. Calibrate temperature switches to make or break contacts.
- 5. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
- 6. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
- 7. Provide diagnostic and test instruments for calibration and adjustment of system.
- B. Adjust initial temperature set points.
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

3.07 DEMONSTRATION

- A. Provide a qualified instructor (or instructors) with five years minimum field experience with the installation and programming of similar control systems. Orient training to the specific systems installed. Coordinate training times with the Owner. Training shall take place at the job site.
- B. Demonstration and training for equipment controls shall be by that vendor, or a qualified instructor. For example, boiler control training will need to be provided by the Viessmann rep.
- C. Provide basic control system fundamentals training.
 - 1. This project's list of control system components
 - 2. This project's sequences of control

END OF SECTION

SECTION 23 09 93

SEQUENCE OF OPERATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 1
 - 2. Division 23 Section - Common Work Results
 - 3. Division 23 Section – Direct Digital Control (DDC) System
 - 4. Other Sections – Equipment with built in DDC controllers.
 - 5. Division 23 Section - Testing, Adjusting, and Balancing
 - 6. Division 26 - Electrical
 - 7. Division 27 – Communications
 - 8. Division 28 – Electronic Safety & Security, Fire Alarm

1.02 GENERAL

- A. Control sequences are intended to be performance based. Implementations that provide the same functional result using different underlying detailed logic will be acceptable. As noted, control sequences shall be in accordance with ASHRAE Guideline 36-2021.
- B. All points shown in the points list or described in the sequence shall be shown on the graphics.
- C. All setpoints including setpoints internal to control algorithms shall be adjustable from all BAS operator interfaces. All commands shall be overridable from all BAS operator interfaces. All control points shall be adjustable or overridable from the same graphic page that displays the points.
- D. All setpoints, timers, deadbands, PID gains, etc. listed in sequences shall be adjustable by the user with appropriate access level whether indicated as adjustable in sequences or not. Software points shall be used for these variables. Fixed scalar numbers shall not be embedded in programs except for physical constants and conversion factors.
- E. All points required by the sequence of operation including, but not limited to, the points listed in the sequences of operation below, as well as all the points' associated values, shall be connected to the BAS and available to the BAS operators on all operator workstations and all operator interface devices as part of a graphical display that depicts the mechanical system controlled.
- F. Unless otherwise indicated, control loops shall be enabled and disabled based on the status of the system being controlled to prevent windup.
- G. When a control loop is enabled or reenabled, it and all its constituents (such as the proportional and integral terms) shall be set initially to a neutral value.

- H. A control loop in neutral shall correspond to a condition that applies the minimum control effect, i.e., valves/dampers closed, VFDs at minimum speed, etc.
- I. When there are multiple OA temperature sensors, the system shall use the valid sensor that most accurately represents the OA conditions at the equipment being controlled.
- J. The term "control loop" or "loop" is used generically for all control loops. These will typically be PID loops, but proportional plus integral plus derivative gains are not required on all loops. Unless specifically indicated otherwise, the guidelines in the following subsections shall be followed.
 - 1. Use proportional only (P-only) loops for limiting loops (such as zone CO2 control loops, etc.). Limiting loops are used to prevent controlled variables from rising above or dropping below setpoint (depending on the application) by defining a fixed threshold at which the loop output reaches 100%. Limiting loops shall use proportional-only control to prevent integral windup from causing the controlled sensor to overshoot setpoint due to the sensor generally being far from setpoint.
 - 2. Do not use the derivative (D) term on any loops unless field tuning is not possible without it. Use of the derivative term makes loop tuning difficult in practice. It can make loops unstable because it increases as the rate of change of the error increases, amplifying the error signal. It is used in industrial process controls and systems that must react quickly but is rarely if ever needed in HVAC system.
 - 3. Limit PID maximum change to 25%, make this a user modifiable variable.
- K. When HVAC equipment or a sequence is specified to be started and stopped by a temperature, humidity, pressure setpoint or any other controlled variable, there shall be an adjustable differential setpoint that shall be set to prevent short cycling of the systems and equipment due to minor changes in the controlled variable. Temperature differential setpoints shall be set at 2°F and non-temperature setpoints shall be set at 10% of the controlled range unless otherwise specified. Setpoints shall indicate at when the process should be turned ON. Heating and cooling differentials shall be set for above setpoint and will be used to turn the process OFF. For example, an economizer sequence called to switch at 68°F, would turn ON at 68°F and OFF at 70°F since it is a cooling function. A heating lockout setpoint of 50 °F would turn ON heating control at 50°F and OFF at 52°F Non-temperature differentials shall be set above setpoint if the setpoint is indicating a minimum value or below setpoint if the setpoint is indicating a maximum value. Provide minimum runtime timers for loads that are cycled to prevent over-cycling. Timers shall be set as specified or as needed to prevent damage or excessive wear to the equipment. Unless otherwise specified in the individual control sequences, fans and pumps shall have a minimum runtime ON timers of 15 minutes (adj.) and OFF timers of 5 minutes (adj.). Safeties shall override runtime timers.
- L. To avoid abrupt changes in equipment operation, the output of every control loop shall be capable of being limited by a user adjustable maximum rate of change, with a default of 25% per minute.
- M. Provide minimum runtime timers for loads that are cycled to prevent over-cycling. Timers shall be set as specified or as needed to prevent damage or excessive wear to the equipment. Safeties shall override runtime timers.
- N. All setpoints, timers, deadbands, PID gains, etc. listed in sequences shall be adjustable by the user with appropriate access level whether indicated as adjustable in sequences or not. Software points shall be used for these variables. Fixed scalar numbers shall not be embedded in programs except for physical constants and conversion factors.
- O. The BAS contractor is responsible for utilizing the functional performance test procedures developed by the commissioning agent in accordance with the procedures defined for functional performance test procedures.

- P. Values for all points, including real (hardware) points used in control sequences shall be capable of being overridden by the user with appropriate access level (e.g., for testing and commissioning). If hardware design prevents this for hardware points, they shall be equated to a software point, and the software point shall be used in all sequences. Exceptions shall be made for machine or life safety.
1. All hardware points, not just inputs, shall be capable of being overridden for purposes of testing and commissioning. For example, the commissioning agent shall be able to command damper positions, valve positions, fan speeds, etc. directly through BAS overrides.
 2. The requirement to equate hardware points to software points is necessary for systems that do not allow overriding real input points.
 3. The user interface shall allow the user to set an expiration period that automatically releases the override after the period has expired. The system shall also keep track of who initiates each override and when.
- Q. Provide Sequenced starting of HVAC equipment at initial startup, whether specifically mentioned in each Sequence of Operation.
- R. All setpoints indicated in the control specification are to be adjustable. The setpoints indicated herein are only specified as a calculated starting point (or initial system operation). It is expected that setpoint adjustments and control loop tuning shall be required to provide optimum system operation based on the requirements of the building. The control contractor shall work with the TAB contractor (230593) and the Owner to provide the final system setpoint adjustments and control loop tuning after the system is in operation and building is in use.
- S. BACnet
1. All controllers with BACnet cards shall be integrated into the DDC system via BACnet. Provide DDC programming to define input and output information available through the boiler manufacturer's integration data port.
 2. All hardwired points and any setpoints, timers, or other control elements that are specified to be adjustable (adj.) shall be mapped as BACnet objects and be available on the user interface to be adjusted.
- T. Trends shall be provided for all hardware I/O points and integrated points listed as having trending and for analog and binary data points mapped to the user interface. Interval trending with sample intervals of 10 minutes shall be provided on analog process variables (this includes both analog inputs and calculated process variables) and process outputs. Data shall be stored at the supervisory controller or in the field controller and uploaded to the DDC system server when archiving is desired. Consult with the Owner to determine which trends should be archived. Trending shall be in place for a minimum of 24 hours prior to functional testing by the commissioning provider. The BAS shall sample and store trend data and shall be able to archive data to the hard disk.
- U. Variable Frequency Drives (VFD) Speed Points per ASHRAE Guideline 36-2021:
1. The speed AO sent to VFDs shall be configured such that 0% speed corresponds to 0 Hz, and 100% speed corresponds to maximum speed configured in the VFD.
 2. For each piece of equipment, the minimum speed shall be stored in a single software point; in the case of a hard-wired VFD interface, the minimum speed shall be the lowest speed command sent to the drive by the BAS. The active minimum speed parameter shall be read every 60 minutes via the drive's network interface. When a mismatch between the drive's active minimum speed and the minimum speed stored in the software point is detected, the minimum speed stored in the software point shall be written to the VFD via

- the network interface to restore the active minimum speed parameter to its default value and generate a Level 4 alarm.
3. The VFD start-up technician shall work with the BAS Contractor to determine the minimum speed required for the motor controlled by the VFD to provide cooling of the motor as installed to prevent heat related problems. This minimum speed shall be set in the VFD controller.

V. Point Types

1. AO = analog output
2. DO = digital output (also, BO = binary output)
3. AI = analog input
4. DI = digital input (aka BI = Binary Input)

1.03 ALARMS

- A. Provide alarms per ASHRAE Guideline 36, Paragraph 5.1.12: "Alarms".
- B. Provide at least the following requirements in the specification for the BAS graphical user interface:
 1. All alarms shall include a time/date stamp using the standalone control module time and date.
 2. Each alarm can be configured in terms of level, latching (Requires Acknowledgment of a Return to
 3. Normal/Does Not Require Acknowledgment of a Return to Normal), entry delay, exit deadband, and post-suppression period.
 4. An operator shall be able to sort alarms based on level, time/date, and current status. Alarms should be reported with the following information:
 - a. Date and time of the alarm
 - b. Level of the alarm
 - c. Description of the alarm
 - d. Equipment tags for the units in alarm.
 - e. Possible causes of the alarm if provided by the fault detection routines.
 - f. The source that serves the equipment in alarm, per ASHRAE Guideline 36, Paragraph 5.1.19 "Hierarchical Alarm Suppression".
- C. As per ASHRAE Guideline 36, there shall be 4 levels of alarm:
 1. Level 1: Life-safety message
 2. Level 2: Critical equipment message
 3. Level 3: Urgent message
 4. Level 4: Normal message
- D. Alarms shall be reset during a power failure; the controls shall be programmed to ignore alarms that will occur upon loss of power. For example, a pump status alarm is not necessary, since it's obvious that the pump will fail upon loss of power.
- E. Alarms associated with equipment that is disabled shall be inhibited.
- F. Current status-switches shall prove the operation of fans and pumps. Level 2 Alarm, Fans & pumps: Status point not matching it's ON/OFF point for 3 seconds after a time delay of 15 seconds while the equipment is commanded ON. The term "proven" (i.e., "prove ON"/ "prove OFF") shall

mean that the equipment's DI status point (current switch) matches the state set by the equipment's DO command point.

- G. If an operating equipment has any fault condition, a Level 2 alarm shall be generated, and a response shall be triggered as defined in ASHRAE Guideline 36.

1.04 TRIM & RESPOND (T&R) SET-POINT RESET LOGIC

- A. Provide T&R logic per ASHRAE Guideline 36, Paragraph 5.1.14: "Trim & Respond Set-Point Reset Logic".
- B. Trim & Respond logic shall reset the setpoint within the range minimum (SPmin) to maximum (SPmax) setpoint. When the associated device is OFF, the setpoint shall be SP0.
- C. T&R logic resets a setpoint for pressure, temperature, or other variables. It reduces the setpoint at a fixed rate until a downstream zone is no longer satisfied and generates a request. When enough requests are present, the setpoint is increased in response. The importance of each zone's requests can be adjusted to ensure that critical zones are always satisfied. When enough requests no longer exist, the setpoint resumes decreasing at its fixed rate. A running total of the requests generated by each zone is kept identifying zones that are driving the reset logic.
- D. Damper/Valve Position: Knowledge of damper and valve position are required for proper generation of T&R reset requests. The following are acceptable methods for determining position:
1. Analog actuator. Position may be assumed to be equal to analog signal to actuator.
 2. Floating actuator. Provide either:
 - a. Position feedback AI
 - b. Position estimated by timing pulse-open and pulse-closed commands with autozeroing whenever zone is in Unoccupied Mode and damper is driven full closed. This option is not acceptable for 24/7 applications.

PART 2 - SEQUENCES

2.01 BASIS OF DESIGN

- A. The setpoints indicated are only specified as a calculated starting point (or initial system operation). It is expected that setpoint adjustments and control loop tuning shall be required to provide optimum system operation based on requirements of the building. The control Contractor shall work with the balancing Contractor and the Owner to provide the final system setpoint adjustments and control loop tuning after the system is in operation and building is in use. Document all final setpoints on the as-built control drawings. Any questions regarding the intended operation of the HVAC equipment and control systems shall be referred to the HVAC design engineer through the appropriate construction communication process. The following setpoints should be used as initial setpoints unless otherwise specified in the individual control sequences:

Type of Area	Winter DB	Summer DB
Office	70°F	75°F
Corridor	70°F	78°F
Classroom	70°F	75°F
Other, if not listed	70°F	75°F

Mechanical Spaces	65°F	78°F
IT Rooms	55°F	85°F
Electrical Closets	55°F	76°F
Electrical Switchgear	55°F	78°F
Storage Rooms	55°F	100°F

- B. Heating systems shall be equipped with controls configured to automatically restart and temporarily operate the system as required to maintain zone temperatures above an adjustable heating setpoint down to 55°F.
- C. Cooling systems shall be equipped with controls configured to automatically restart and temporarily operate the mechanical cooling system as required to maintain zone temperatures below an adjustable cooling setpoint up to 85°F or to prevent high space humidity levels.
Outside Air (OA) Conditions
 - 1. The controller shall monitor the OA temperature and humidity and calculate the OA enthalpy on a continual basis. These values shall be always made available to the system.
 - 2. Level 3 alarm shall be generated for Sensor Failure: Sensor reading indicates shorted or disconnected sensor. In the event of a sensor failure, an alternate OA conditions sensor shall be made available to the system without interruption in sensor readings.
 - 3. If an OA Temp Sensor cannot be read, a default value of 0°F shall be used.
 - 4. If an OA Humidity Sensor cannot be read, a default value of 50 % shall be used.

2.02 ROOFTOP AIR HANDLING SYSTEMS (RTU)

- A. The RTU unit shall be enabled by the BAS.
 - 1. Programmable schedule, and on/off.
- B. Provide a space temperature/humidity sensor with output signal to the RTU controller.
 - 1. Provide multiple temperature and humidity sensors, minimum of four (x4), for space averaging.
- C. Factory DDC controller provided by RTU unit manufacturer, coordinate with Section 23 74 33. The factory controller includes control of the following:
 - 1. Supply & return fans (single zone VAV)
 - 2. Supply air temperature
 - 3. Airflows, all airstreams
 - 4. Heating
 - 5. Cooling
 - 6. Dehumidification
- D. Provide monitoring and alarm points as per the manufacturer's Points List.
- E. Duct smoke detectors shall be provided in SA and RA stream. Installation in the ductwork and connection to the control system shall be under Division 23. Detector furnished and wired to the fire alarm system by Division 26. Activated when products of combustion are detected in air stream. Smoke detector shall signal an alarm and shut down the unit when products of combustion are detected in airstream.
- F. Maintain supply duct static pressure for VAV systems.

- G. Freeze Protection: Upon signal from the freeze-stat, or if SA temperature drops below 40°F for 5 minutes, shut down the unit.
- H. 10-Ton RTUs SOO:
 - 1. See Tempmaster - Installation Manual: WP Series, 6.5 ton to 12.5 ton, heat pump R-454B, 60 Hz. Provide all sensors and hardware required and recommended by the unit manufacturer.
 - 2. Cooling SOO
 - a. For the WP series of units, the thermostat makes a circuit between R and Y1 for the first stage of cooling. The call is passed to the Unit Control Board (UCB), which then determines whether the requested operation is available and, if so, energizes ID fan contactor M3, compressor #1 contactor M1, condenser fans contactor M4 and reversing valves relay RW1. If the (UCB) receives call for second stage cooling from the thermostat, R and Y2, then the UCB energizes compressor #2 contactor M2 for full cooling operation. If at any time a call for both heating and cooling are present, the heating operation will be performed. If operating, the cooling system is halted as with a completion of a call for cooling. Heating always takes priority.
 - 3. Economizer With Single Enthalpy Sensor
 - a. When the room thermostat calls for first-stage cooling, the low voltage control circuit from R to G and Y1 is completed. The UCB energizes the blower motor when the fan switch on the room thermostat is set in the AUTO position and drives the economizer dampers from fully closed to their minimum position. If the enthalpy of the outdoor air is below the setpoint of the enthalpy controller, Y1 energizes the economizer. The dampers modulate to maintain a constant supply air temperature as monitored by the discharge air sensor. If the outdoor air enthalpy is above the setpoint, Y1 energizes compressor #1. When the thermostat calls for second-stage cooling, the low voltage control circuit from R to Y2 is completed. The UCB energizes the first available compressor. If the enthalpy of the outdoor air is below the setpoint of the enthalpy controller, for example the first stage has energized the economizer, Y2 energizes compressor #1. If the outdoor air is above the setpoint, Y2 energizes compressor #2. When the thermostat is satisfied, it de-energizes Y1 and Y2. If the compressors have satisfied their minimum run times, the compressors and condenser fans are de-energized. Otherwise, the unit operates each cooling system until the minimum run times for the compressors are completed. Upon the final compressor de-energizing, the blower is stopped following the elapse of the fan off delay for cooling, and the economizer damper goes to the closed position. If the unit is in continuous fan operation, the economizer damper goes to the minimum position.
 - 4. Economizer With Dual Enthalpy Sensors
 - a. The operation with the dual enthalpy sensors is identical to the single sensor except that a second enthalpy sensor is mounted in the return air. This return air sensor allows the economizer to choose between outdoor air and return air, whichever has the lowest enthalpy value, to provide maximum operating efficiency.
 - 5. Economizer with Power Exhaust:
 - a. A unit equipped with an economizer (single or dual enthalpy) and a power exhaust operates as specified above with one addition. The power exhaust motor is energized 45 seconds after the actuator position exceeds the exhaust fan set point

on the economizer control. As always, the R to G connection provides minimum position but does not provide power exhaust operation.

6. Cooling Operation Errors

- a. Each cooling system is monitored for operation outside of the intended parameters. Errors are handled as described below. All system errors override minimum run times for compressors.

7. High-Pressure Limit Switch

- a. During cooling operation, if a high-pressure limit switch opens, the UCB de-energizes the associated compressor, initiates the ASCD (Anti-short cycle delay), and, if the other compressor is idle, stops the condenser fans. If the call for cooling is still present at the conclusion of the ASCD, the UCB re-energizes the halted compressor. If a high-pressure switch opens three times within 2 hours of operation, the UCB locks out the associated compressor. If the other compressor is inactive, the condenser fans are deenergized.

8. Low-Pressure Limit Switch

- a. The low-pressure limit switch is not monitored during the initial 30 seconds of a cooling system's operation. For the following 30 seconds, the UCB monitors the low-pressure switch to ensure it closes. If the low-pressure switch fails to close after the 30 seconds monitoring phase, the UCB deenergizes the associated compressor, initiates the ASCD, and, if the other compressor is idle, stops the condenser fans. When the low-pressure switch is proven (closed during the 30 seconds monitor period described above), the UCB monitors the low-pressure limit switch for any openings. If the lowpressure switch opens for greater than 5 seconds, the UCB de-energizes the associated compressor, initiates the ASCD, and, if the other compressor is idle, stops the condenser fans. If the call for cooling is still present at the conclusion of the ASCD, the UCB re-energizes the halted compressor. If a low-pressure switch opens three times within 1 hour of operation, the UCB locks out the associated compressor. If the other compressor is inactive, the condenser fans are deenergized.

9. Evaporator Low Limit

- a. During cooling operation, if the Evaporator Low Limit Sensor (EC1, 2), located on the suction line at the evaporator coil, detects a temperature below the default 26°F, the UCB de-energizes the associated compressor, initiate the ASCD, and, if the other compressor is idle, stop the condenser fans. If the call for cooling is still present at the conclusion of the ASCD, the UCB re-energizes the halted compressor. If the UCB detects the evaporator low limit sensor (EC1, 2) falling below 26°F (default) three times within 2 hours of operation, the UCB locks out the associated compressor. If the other compressor is inactive, the condenser fans are de-energized.

10. Low Ambient Cooling

- a. To determine when to operate in low ambient mode, the UCB has an Outdoor Air Temperature Sensor (OAT) with a low ambient setpoint at 45°F (default). When the OAT Sensor senses a temperature below the low ambient setpoint and the thermostat is calling for cooling, the UCB operates in the low ambient mode. Low ambient mode operates the compressors in this manner: 10 minutes on, 5 minutes

off. The indoor blower is operated throughout the cycle. The 5 minute off period is necessary to defrost the indoor coil. Low ambient mode always begins with compressor operation. Compressor minimum run time may extend the minutes of compressor operation. The off cycle begins immediately following the elapse of the minimum run time. When operating in low ambient mode, an evaporator low limit sensor (EC1, 2) temperature below 26°F de-energizes the associated compressor. If the call for cooling is still present at the end of the ASCD and the and the evaporator temperature sensor (EC1, 2) temperature is above 26°F, the unit will resume operation.

11. Safety Controls

- a. The unit control board monitors the following inputs for each cooling system: 1. 2. 3.
 - 1) An evaporator low limit sensor (EC1, 2), located on the suction line at the evaporator coil, to protect against low evaporator temperatures due to a low airflow or a low return air temperature, set at 26°F.
 - 2) A high-pressure switch to protect against excessive discharge pressures due to a blocked condenser coil or a condenser motor failure, (opens at 625 ± 25 psig).
 - 3) A low-pressure switch to protect against loss of refrigerant charge, (opens at 22 ± 5 psig).
- b. The above pressure switches are hard-soldered to the unit. The refrigeration systems are independently monitored and controlled. On any fault, only the associated system is affected by any safety/preventive action. The other refrigerant system continues in operation unless it is affected by the fault as well. The unit control board monitors the temperature limit switch of units with electric heat.

12. Compressor Protection

- a. In addition to the external pressure switches, the compressors also have inherent (internal) protection. If there is an abnormal temperature rise in a compressor, the protector will open to shut down the compressor. The UCB incorporates features to minimize compressor wear and damage. An Anti-Short Cycle Delay (ASCD) is used to prevent operation of a compressor too soon after its previous run. Additionally, a minimum run time is imposed any time a compressor is energized. The ASCD is initiated on unit start-up and on any compressor reset or lock-out.

13. Reset

- a. Remove the call for cooling, by raising thermostat setting higher than the conditioned space temperature.

14. Reheat Mode Sequence Of Operation

- a. The MagnaDRY reheat mode of operation is designed to remove latent heat (humidity) from a space when there are low load conditions and the air conditioning unit is not used to cool the space. The general sequence of operation of the patented MagnaDRY reheat is outlined in the following paragraphs. The user can select three different modes of operation from the unit control board (UCB) within the Smart Equipment™ controller menu. The available modes are normal, alternate, and aux. The following sections describe each mode.

15. Normal Cooling Mode

- a. When there is a call for first stage cooling, with or without a call for dehumidification, the UCB de-energizes SOL-CC and energizes SOL-RH. The unit is now in first stage cooling without HGRH. When there is a call for second stage cooling, the UCB engages both circuit #1 and circuit #2 in cooling mode. The indoor blower operation is always initiated upon a call for first stage cooling, second stage cooling or dehumidification (HGRH). The unit does not operate in the reheat mode if there is any call for heating. On units with economizers, the unit does not operate in the reheat mode if there is a call for cooling and the economizer is operating as first stage of cooling. All safety devices function as previously described.

16. Normal Reheat Mode

- a. When the UCB detects a need for dehumidification through the field installed return/space humidity sensor and there is not a call for cooling, the UCB energizes solenoid SOL-CC and the reheat relay (RHR), which de-energizes SOL-RH. The unit then operates with refrigerant flow in the evaporator reheat coil and condenser coil circuit no. 1.

17. Alternate Mode

- a. When the Unit Control Board (UCB) detects a need for dehumidification via the field installed return/space humidity sensor and there is not a call for cooling, the UCB energizes SOL-CC, and de-energizes SOL-RH. The unit then operates with circuit #1 in reheat mode and circuit #2 in cooling mode. When there is a call for first stage cooling while there is still a call for dehumidification, no operational change is made. The call for cooling is ignored and the unit continues to operate with circuit #1 in reheat mode and circuit #2 in cooling mode. When there is a call for second stage cooling, the UCB de-energizes the HGR, which de-energizes SOL-CC, and energizes SOL-RH. Both circuits now operate in the cooling mode. The indoor blower operation is always initiated upon a call for first stage cooling, second stage cooling or dehumidification (HGRH). The unit does not operate in the reheat mode if there is any call for heating or two stage cooling. On units with economizers, the unit will not operate in the reheat mode if there is a call for cooling and the economizer is operating as first stage of cooling. All safety devices function as previously described.

18. Heat Pump Heating SOO w/ Electric Heat

- a. When the thermostat calls for heating, the low voltage control circuit is completed between R and W1 for heating. The call is passed to the UCB, which then determines whether the requested operation is available and if so, energizes ID fan contactor M3, compressor #1 contactor M1. After a 2 second delay, it then energizes compressor #2 contactor M2. As a result, on a call for heat from W1, both sets of compressors are always energized, unless one or the other is locked out by the UCB. Also on the call for heat, the UCB energizes the M4 contactor which brings on the condenser fans. If the compressors alone cannot satisfy the heating requirements a second stage call from the thermostat completes the circuit between R and W2. The call is passed through the UCB to the electric heat section (if available). For the 9 kW heater 9 kW is energized, for the 18 kW heater 18 kW is energized, for the 24 kW heater 24 kW is energized, for the 36 kW heater 36 kW is energized, and for 54 kW heater 36 kW is energized. In the event that all compressors are locked out by the UCB, the total available kW of electric heat is energized. In the event of a needed defrost the defrost control signals the UCB,

which de-energizes the condenser fans contactor M4 and energizes the reversing valves relay RW1, putting the unit into defrost.

19. Defrost Initiation

- a. Defrost control implements a temperature differential, demand defrost algorithm. The heat pump operates in the heating mode until the combination of outdoor ambient temperature and outdoor coil temperature indicate that defrosting is necessary. When the coil temperature is maintained below the initiate point for a given ambient temperature, continuously for 4 1/2 minutes, the heat pump is put into a defrost cycle. This 4 1/2 minutes timer eliminates unnecessary defrost cycles caused by refrigeration surges such as those that occur at the start of a heating cycle. For defrost, the UCB signals the energizing of the reversing valve and de-energizing the systems condenser fan motors. The unit's optional electric or gas first-stage heater is also energized via a 24 V VAC output terminal labeled H2.

20. Defrost Termination

- a. The UCB terminates the defrost mode when either of the following two conditions are met: 1. The outdoor coil temperature sensor reaches 50°F, or 2. The maximum allowable defrost run time of 8 minutes.

21. Interval Between Defrosts

- a. A timed inhibit feature prevents the system from responding to a call for defrost less than 40 minutes after the initiation of the previous defrost. After this inhibit time has expired, temperature conditions must call for defrost continuously for 4 1/2 minutes before another defrost cycle is initiated. A temperature inhibit feature prohibits defrost if the coil temperature is above 40°F. All defrost timing occurs only while the compressor is on.

22. Forced Defrost

- a. A forced-defrost feature puts the system into a defrost cycle every 6 hours and 4 minutes to recirculate lubricants, unless the coil temperature is above 40°F. All defrost timing occurs only while the compressor is on. For troubleshooting purposes, the defrost cycle can be manually initiated by selecting Test Defrost in the UCB menu.

23. Electric Heat Operations Errors - Temperature Limit

- a. If the UCB senses 0 V from the high temperature limit, the indoor blower motor is immediately energized. This limit is monitored regardless of unit operation status, that is. the limit is monitored at all times. If the temperature limit opens three times within 1 hr, it locks on the indoor blower motor.

24. Safety Controls

- a. The UCB monitors the temperature limit switch of electric heat units.

25. Limit Switch (LS)

- a. The limit switch (LS) is located inside the heater compartment and is set to open at the temperature indicated in Table 41. It resets automatically. The limit switch operates when a high temperature condition caused by inadequate supply air flow

occurs. This shuts down the heater and energizes the blower. All electric heaters are provided with single use backup protection limits. These deenergize the heaters if the primary limit fails to open or the contactors fail to open in a failure mode. When the backup limit trips it will need to be replaced for the heater to be operational again.

26. Reset

- a. Remove the call for heating by lowering the thermostat setting lower than the conditioned space temperature.

27. Electric Heat Anticipator Setpoints

- a. The anticipator setpoint must be correct. Too high of a setting results in longer heat cycles and a greater temperature swing in the conditioned space. Reducing the value below the correct setpoint gives shorter ON cycles and may result in the lowering of the temperature within the conditioned space. See manufacturer's table for the correct setting.

I. 25-Ton or Greater RTUs SOO:

1. See Tempmaster - Installation Manual: TEMPMASER® Omni Choice MV13 to MV25 Heat Pump R-454B.
2. Provide all required sensors and hardware as required and recommended by the manufacturer.
3. Similar to 10-Ton sequence above with minor differences below.
4. Cooling Sequence Of Operation (This Section Assumes Free Cooling Is Not Available)
 - a. During cooling, the control energizes the H1 output to turn on the Reversing Valve. The H1 output to the reversing valves SOL1 and SOL2 remains energized between calls for cooling. If a heating call arises, the H1 output turns off.
 - b. Compressors are controlled by the Y1 through Y2 thermostat inputs. If the Lead/Lag function is turned OFF, a Y1 input energizes the C1 output. Thermostat Input into Y2 energizes the C2 output respectively.
 - c. The FAN output for indoor fan operation energizes with any cooling output after the Fan On Delay for Cool expires.
 - d. CN-FAN output energizes when either C1 or C2 is energized
 - e. A 30 second interstage delay occurs when multiple stages are requested. When the thermostat cooling inputs are lost and the minimum runtime expires, the compressor outputs stage off.
5. Heating Sequence Of Operation
 - a. For heating, a call for W1 for the first stage of heating or heat pump mode, the UCB drives both the C1, C2 compressor contactor, M4 & M6 outdoor fan contactors ON and de-energizes Sol1 & Sol2 reversing valve into heat pump mode. A "W1" call runs 100% of compression for heating mode.
 - b. The thermostat makes a circuit between "R" and "W2" for the second stage of heating. The UCB passes the "W2" signal on energizing a contactor (HC1), which energizes the first stage of electric heaters if available.
 - c. In both cases, when the W1 call is sensed, the indoor air blower is energized following a specified heating delay.
 - d. If at any time a call for both heating and cooling are present, the heating operation will be performed. If operating, the cooling system is halted as with a completion of a call for cooling. Heating always takes priority.

- e. If both compressors C1 & C2 are in lock out condition the second stage of the electric heaters will be energized as 16.7 kW for 50 kW option, 37.5 kW for option of 75 kW.

2.03 DUCT SMOKE DETECTORS

- A. Smoke detectors shall be installed in return air systems with a design capacity greater than 2,000 CFM, in the RA duct or plenum upstream of any filters, exhaust air connections, or OA connections.
- B. Return air risers: Where return air risers serve two or more stories and serve any portion of a return air system having a design capacity greater than 15,000 CFM, smoke detectors shall be installed at each story. Smoke detectors shall be located upstream of the connection between the return air riser and any air ducts or plenums.
- C. Provide in ductwork and connect to the BAS by Division 23. Detector shall be furnished and wired to the fire alarm system by Division 26.
- D. The unit shall shut down, Level 1 alarm, in response to a signal from the smoke detector indicating the presence of smoke. The smoke detector shall be interlocked to the unit through the dry contacts of the smoke detector. A manual reset of the smoke detector shall be required to restart the unit.

2.04 DUCT SMOKE DAMPERS

- A. Smoke dampers provided in ducts are required to close by building code in the event their associated smoke detectors are in alarm.
- B. Smoke detectors: Zero flow type, furnished with smoke dampers, see Section 23 31 13 "Metal Ducts".
- C. For software interlocks of smoke dampers to the fan systems, the smoke dampers shall be commanded open and closed on fan status through the DDC smoke damper control output.
- D. Provide with safety circuit hardwire interlocks: if fan fails to start after an appropriate time delay (not longer than five minutes), smoke dampers shall close through the DDC smoke damper control output, the fan shall be latched OFF, and an alarm sent through the DDC system. A software reset point, and a momentary pushbutton located at the temperature control panel for the associated fan system shall be provided to reset the fan system. On fan system start-up, a time delay shall allow the dampers to open before the fan is started. All necessary software and hardware interlocks shall be provided to perform these functions.
- E. The smoke dampers shall be hardwire interlocked to the associated fire alarm control module to close whenever the fire alarm control module indicates an alarm to shut down the associated AHU.
- F. Alarms shall be provided for each smoke damper by the BAS contractor. The alarm shall be generated when the smoke damper is not in its commanded position after the appropriate time delay allowing for the smoke damper to actuate fully. Alarms shall be provided regardless of if the smoke damper command is from the DDC system or fire alarm system. Binary inputs to the DDC system from the fire alarm system devices commanding the AHU systems and associated dampers shall be provided for to allow for required alarms.

- G. For smoke dampers that are controlled by individual zero-flow duct smoke detectors in shaft penetrations and the AHU system is not programmed to shut down, these smoke dampers shall go into alarm whenever they close.

2.05 TERMINAL UNITS – COMMON REQUIREMENTS

- A. Each zone shall have separate occupied and unoccupied heating and cooling setpoints.
- B. The active setpoints shall be determined by the operating mode of the Zone Group. Zone scheduling groups, or Zone Groups, are sets of zones served by a single air handler that operate together for ease of scheduling and/or to ensure sufficient load to maintain stable operation in the upstream equipment.
 - 1. The set points shall be the occupied set points during occupied mode, warm-up mode, and cooldown mode.
 - 2. The set points shall be the unoccupied set points during unoccupied mode, setback mode, and setup mode.
- C. The software shall prevent the following:
 - 1. The heating setpoint from exceeding the cooling setpoint minus 1°F (i.e., the minimum difference between heating and cooling setpoints shall be 1°F).
 - 2. The unoccupied heating setpoint from exceeding the occupied heating setpoint.
 - 3. The unoccupied cooling setpoint from being less than the occupied cooling setpoint.
- D. The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.
 - 1. The adjustment shall be capable of being limited in software.
 - a. As a default, the active occupied cooling setpoint shall be limited between 73°F and 80°F.
 - b. As a default, the active occupied heating setpoint shall be limited between 65°F and 72°F.
 - 2. The active heating and cooling setpoints shall be independently adjustable, respecting the limits and anti-overlap logic. If zone thermostat provides only a single set-point adjustment, then the adjustment shall move both the active heating and cooling setpoints upward or downward by the same amount.
 - 3. The adjustment shall only affect occupied setpoints in Occupied Mode, Warmup Mode, and Cooldown Mode and shall have no impact on setpoints in all other modes.
- E. A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period (60 minutes, adj.). At the expiration of this time, control of the unit shall automatically return to the schedule.
- F. Control Loops
 - 1. Two separate control loops, the Cooling Loop, and the Heating Loop, shall operate to maintain space temperature at setpoint.
 - a. The Heating Loop shall be enabled whenever the space temperature is below the current zone heating set-point temperature and disabled when space temperature is above the current zone heating setpoint temperature, and the loop output is zero

- for 30 seconds. The loop may always remain active if provisions are made to minimize integral windup.
 - b. The Cooling Loop shall be enabled whenever the space temperature is above the current zone cooling set-point temperature and disabled when space temperature is below the current zone cooling set-point temperature and the loop output is zero for 30 seconds. The loop may always remain active if provisions are made to minimize integral windup.
- 2. The Cooling Loop shall maintain the space temperature at the active cooling setpoint. The output of the loop shall be a software point ranging from 0% (no cooling) to 100% (full cooling).
 - 3. The Heating Loop shall maintain the space temperature at the active heating setpoint. The output of the loop shall be a software point ranging from 0% (no heating) to 100% (full heating).
 - 4. Loops shall use proportional + integral logic or other technology with similar performance. Proportional-only control is not acceptable, although the integral gain shall be small relative to the proportional gain. P and I gains shall be adjustable by the operator.
 - 5. See other sections for how the outputs from these loops are used.
 - 6. Deadband: Where used to control both heating and cooling, zone thermostatic controls shall be configured to provide a temperature range or deadband of not less than 5°F within which the supply of heating and cooling energy to the zone is shut OFF or reduced to a minimum.

G. Zone Temperature Alarms

- 1. High-temperature alarm
 - a. If the zone is 3°F above cooling setpoint for 10 minutes, generate a Level 4 alarm.
 - b. If the zone is 5°F above cooling setpoint for 10 minutes, generate a Level 3 alarm.
- 2. Low-temperature alarm
 - a. If the zone is 3°F below the heating setpoint for 10 minutes, generate a Level 4 alarm.
 - b. If the zone is 5°F below the heating setpoint for 10 minutes, generate a Level 3 alarm.
- 3. Suppress zone temperature alarms as follows:
 - a. After zone setpoint is changed.
 - b. While Zone Group is in Warmup Mode or Cooldown Mode.

2.06 VAV TERMINAL UNITS

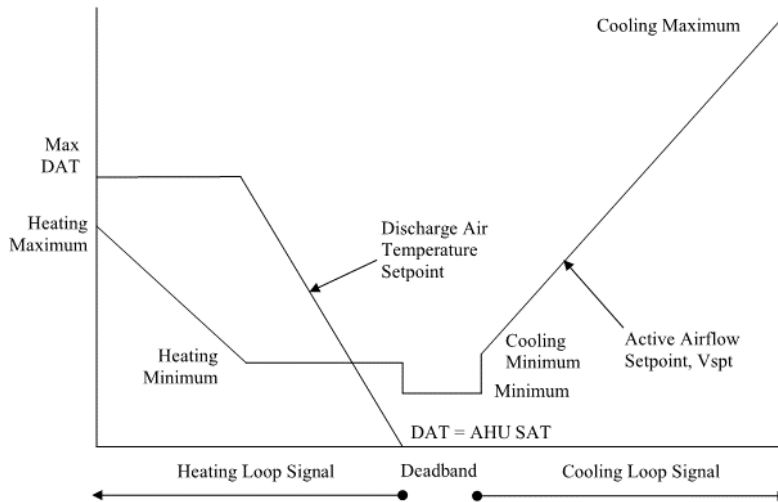
- A. VAV Terminal Unit with Reheat Active endpoints used in the control logic depicted in Figure 5.6.5 shall vary depending on the mode of the Zone Group the zone is a part of (see Table 5.6.4).

Table 5.6.4 Endpoints as a Function of Zone Group Mode

Endpoint	Occupied	Cooldown	Setup	Warmup	Setback	Unoccupied
Cooling maximum	Vcool-max	Vcool-max	Vcool-max	0	0	0
Cooling minimum	Vmin*	0	0	0	0	0
Minimum	Vmin*	0	0	0	0	0
Heating minimum	Max (Vheat-min, min*)	Vheat-min	0	Vheat-max	Vheat-max	0
Heating maximum	Max (Vheat-max, min*)	Vheat-max	0	Vcool-max	Vcool-max	0

B.

C. Provide VAV Terminal Unit with Reheat Control logic as shown in Figure 5.6.5 and described in the following subsections.

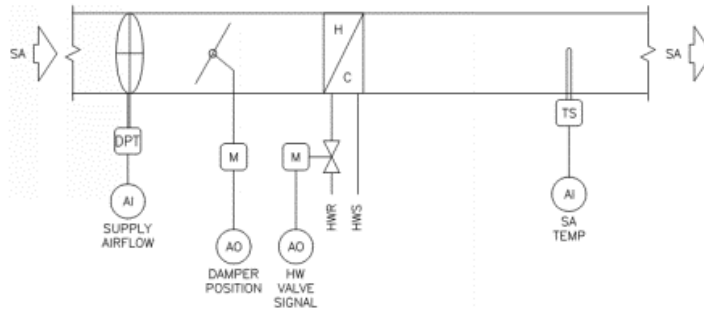


D.

Figure 5.6.5 Control logic for VAV reheat zone.

1. Provide a discharge air temperature sensor.
2. When the Zone State is cooling, the cooling-loop output shall be mapped to the active airflow setpoint from the cooling minimum endpoint to the cooling maximum endpoint. Heating coil is disabled unless the DAT is below the minimum setpoint (50°F).
 - a. If SA temperature from the air handler is greater than room temperature, the active airflow setpoint shall be no higher than the minimum endpoint.
3. When the Zone State is deadband, the active airflow setpoint shall be the minimum endpoint. Heating coil is disabled unless the DAT is below the minimum setpoint (50°F).
4. The purpose of the following heating sequence is to minimize the reheat energy consumption by first increasing the SAT while maintaining minimum flow, and only increasing the total airflow if needed to satisfy the zone: When the Zone State is heating, the Heating Loop shall maintain space temperature at the heating setpoint as follows:
 - a. From 0% to 50%, the heating-loop output shall reset the discharge temperature setpoint from the current AHU SAT setpoint to a maximum of Max Δ T above space temperature setpoint. The active airflow setpoint shall be the heating minimum endpoint.
 - b. From 51% to 100%, if the DAT is greater than room temperature plus 5°F, the heating loop output shall reset the active airflow setpoint from the heating minimum endpoint to the heating maximum endpoint.

- c. The heating coil shall be modulated to maintain the discharge temperature at setpoint. (Directly controlling heating from the zone temperature control loop is not acceptable).
5. In Occupied Mode, the heating coil shall be modulated to maintain a DAT no lower than 50°F.
6. The VAV damper shall be modulated by a control loop to maintain the measured airflow at the active setpoint.



PART 3 -

- A. VAV Alarms: Provide per Guideline 36 Paragraph 5.6.6.
 1. Low Airflow
 2. Low-SA Temperature
 3. Airflow Sensor Calibration. If the fan serving the zone is OFF and airflow sensor reading is above the larger of 10% of the cooling maximum airflow setpoint or 50 cfm for 30 minutes, generate a Level 3 alarm.
 4. Leaking Damper. If the damper position is 0%, and airflow sensor reading is above the larger of 10% of the cooling maximum airflow setpoint or 50 CFM for 10 minutes while the fan serving the zone is proven ON, generate a Level 4 alarm.
 5. Leaking Valve. If the valve position is 0% for 15 minutes, DAT is above AHU SAT by 5°F, and the fan serving the zone is proven ON, generate a Level 4 alarm.
- B. VAV Testing/Commissioning Overrides. Provide software switches that interlock to a system level point to:
 1. force zone airflow setpoint to zero,
 2. force zone airflow setpoint to Vcool-max,
 3. force zone airflow setpoint to Vmin,
 4. force zone airflow setpoint to Vheat-max,
 5. force damper full closed/open,
 6. force heating to OFF / close, and
 7. reset request-hours accumulator point to zero (provide one point for each reset type listed in the next section).
- C. VAV System Requests
 1. Cooling SAT Reset Requests
 - a. If the zone temperature exceeds the zone's cooling setpoint by 5°F for 2 minutes and after suppression period due to setpoint change, send 3 requests.
 - b. Else if the zone temperature exceeds the zone's cooling setpoint by 3°F for 2 minutes and after suppression period due to setpoint change, send 2 requests.

- c. Else if the Cooling Loop is greater than 95%, send 1 request until the Cooling Loop is less than 85%.
 - d. Else if the Cooling Loop is less than 95%, send 0 requests.
- 2. Static Pressure Reset Requests
 - a. If the measured airflow is less than 50% of setpoint while setpoint is greater than zero and the damper position is greater than 95% for 1 minute, send 3 requests.
 - b. Else if the measured airflow is less than 70% of the setpoint while the setpoint is greater than zero and the damper position is greater than 95% for 1 minute, send 2 requests.
 - c. Else if the damper position is greater than 95%, send 1 request until the damper position is less than 85%.
 - d. Else if the damper position is less than 95%, send 0 requests.
- D. For VAV zones with CO2 sensors: When in the occupied mode, the controller shall measure the zone CO2 concentration and modulate the zone damper open on rising CO2 concentrations, overriding normal damper operation to maintain a CO2 setpoint of not more than 750 ppm (adj.).
- E. For zones with associated perimeter heating, modulate electronic control perimeter heating HW valve in sequence (simultaneously) with reheat coil to maintain space temperature when associated AHU is running. When space temperature is below setpoint modulate the HW valve open. The reverse shall occur when space temperature is above setpoint. When the associated AHU is OFF, the radiation valve shall be modulated to maintain heating setpoint and the associated reheat valve shall be closed. Close the perimeter heating valve closed whenever OA is above 50° F (adj.).

3.02 AIR TERMINAL UNITS –FRESH AIR DISTRIBUTION TO ZONES

- A. Occupied Mode
 - 1. The BAS shall schedule the VAV to occupied mode. DOAS shall be running before the VAV operates in the occupied mode.
 - a. Input Device: BAS
 - b. Output Device: VAV box actuator
 - c. Action: The pressure independent VAV box shall provide scheduled minimum OA flow to the space. Refer to the VAV Box schedule for OA flow requirements.
 - 2. CO2 Demand Control Ventilation:
 - a. The pressure independent VAV box shall provide scheduled minimum OA flow to the space. Refer to the VAV Box schedule for OA flow.
 - b. When the zone CO2 sensor is below setpoint, the system will have the terminal damper at minimum position. If the CO2 level exceeds the system will begin to modulate the damper open from minimum to maximum using a PID control loop. When the CO2 level set point is reached the box will stop modulation and begin back toward minimum position.
 - c. CO2 setpoints (adjustable):
 - 1) Classrooms: 940
 - 2) Science Classrooms: 890
 - 3) Computer Labs: 960
 - 4) Conference: 1,200

- 5) Offices: 890
- 6) Multi-Purpose: 1,200
- 7) Unassigned: 940

- d. If the zone needs cooling and the supply temperature is below space temperature, the CO2 sequence shall be overridden and the VAV box shall modulate open to provide space cooling.
- e. Provide CO2 sensors for all classrooms.

- B. Unoccupied Mode: VAV boxes at minimum position.

3.03 EXHAUST FANS

- A. Fan Alarms
 - 1. Maintenance interval alarm when fan has operated for more than 3,000 hours: Level 4. Reset interval counter when alarm is acknowledged.
 - 2. Provide fan fault alarms per Paragraph 1.3 "Alarms".
 - 3. Damper Failure: Commanded open, but the status is closed; Level 2.
- B. See Fan Schedule for sequence type, i.e. heat relief, interlocked, etc.
- C. BAS ON/OFF - Scheduled (Time) Fans: EF shall operate when any of the associated system air handlers are proven ON, and any associated Zone Group is in the Occupied Mode.
- D. Light Switch: Light switch shall energize fan, coordinate with Electrical.
- E. Interlock: Wire to control circuit to energize fan.

3.04 DUCTLESS SPLIT AIR CONDITIONING UNITS

- A. AC unit shall operate by manufacturer-supplied controls and wall thermostat to maintain setpoint during occupied and unoccupied modes.
- B. Integrate with the BAS for start/stop only.
- C. Integrate with the factory condensate detector; Level 3 alarm high condensate level at BAS.

END OF SECTION

SECTION 23 23 00
REFRIGERANT PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 23 Section "Common Work Results"
 - 2. Division 23 Section – "Packaged Condensing Units"
 - 3. Division 23 Section – "Variable-Refrigerant-Flow HVAC Systems"
 - 4. Division 23 Section – "Computer-Room Air-Conditioners"
 - 5. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. Section includes refrigerant pipes, fittings, valves, & specialties for HVAC units.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of valve, refrigerant piping, and piping specialty.
- B. Delegated-Design Submittals: Refrigerant piping layout and design shall be by HVAC unit manufacturer. Include design calculations with corresponding diagram of refrigerant piping and tubing sizing for each system installed.
 - 1. Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes; flow capacities; valve arrangements and locations; slopes of horizontal runs; oil traps; double risers; wall and floor penetrations; and equipment connection details.
 - 2. Show piping size and piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
 - 3. Show interface and spatial relationships between piping and equipment.
 - 4. Include calculations showing that system travel distance for refrigerant piping is within horizontal and vertical travel distances set by HVAC unit manufacturer.
- C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.05 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with ASME Boiler and Pressure Vessel Code: Section IX, "Welding, Brazing, and Fusing Qualifications."
- B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.06 PRODUCT STORAGE AND HANDLING

- A. Store piping with end caps in place to ensure that piping interior and exterior are clean when installed.
- B. Prepare valves and specialties for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads and other end connections.
- C. Use the following precautions during storage:
 - 1. Maintain valve and specialty end protection.
 - 2. Store valves and specialties indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.01 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 280, Type ACR.
- B. Wrought-Copper Fittings, Solder Joint: ASME B16.22.
- C. Brazing Filler Metals: AWS A5.8/A5.8M.
- D. Wrought-Copper Unions: ASME B16.22.
- E. Brazing Filler Metals: AWS A5.8/A5.8M.

2.02 VALVES AND SPECIALTIES

- A. Working Pressure Ratings and Temperatures shall be compatible with the system and refrigerant. Provide system components with pressure rating equal to or greater than system operating pressure.
- B. Service Valves:
 - 1. Body: Forged brass with brass cap including key end to remove core.
 - 2. Core: Removable ball-type check valve with stainless-steel spring.

3. Seat: Polytetrafluoroethylene.
 4. End Connections: Copper spring.
- C. Solenoid Valves: Comply with AHRI 760 and UL 429; listed and labeled by a National Recognized Testing Laboratory (NRTL).
- D. Thermostatic Expansion Valves: Comply with AHRI 750.
- E. Moisture/Liquid Indicators:
1. Body: Forged brass.
 2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
 3. Indicator: Color coded to show moisture content in parts per million (ppm).
 4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
 5. End Connections: Socket or flare.
- F. Replaceable-Core Filter Dryers: Comply with AHRI 730.
1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
 2. Filter Media: 10 microns, pleated with integral end rings; stainless-steel support.
 3. Desiccant Media.
 4. Designed for reverse flow (for heat-pump applications).
 5. End Connections: Socket.
 6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
- G. Divided-Flow Specialty Fittings: Where required by HVAC unit manufacturer for proper system operation, HVAC unit manufacturer shall furnish specialty fittings with identification and instructions for proper installation by Installer.
- H. Refrigerant Isolation Ball Valves: Uni-body full port design with Schrader valve for refrigerant service, rated for maximum system temperature and not less than 800 psig pressure, and factory tested under pressure to ensure tight shutoff.

2.03 LINE SETS

- A. Refrigeration line sets: provide by Streamline Duraguard; or approved equal.
1. Copper Tube UL Recognized to 700 PSI MWP
 2. 10-year limited warranty on copper tube
 3. 5-year limited manufacturer warranty on insulation including UV resistance.
 4. Engineered and tested for refrigerant used.
 5. ASTM B1003
 6. Abrasion, weather, and UV resistant polymeric jacket.
 7. Provide with 3/4" wall (R5), insulating properties of elastomeric foam.
 8. Operating Temperature Range: -70°F to +220°F (ASTM C534)
 9. Compliances: ASTM E 84 25/50, 2015 IECC, ASTM G153, UL 94 (fire stop).
 10. Factory Charge: Dehydrated nitrogen.

2.04 SLEEVE SEAL SYSTEMS (WALL OUTLET)

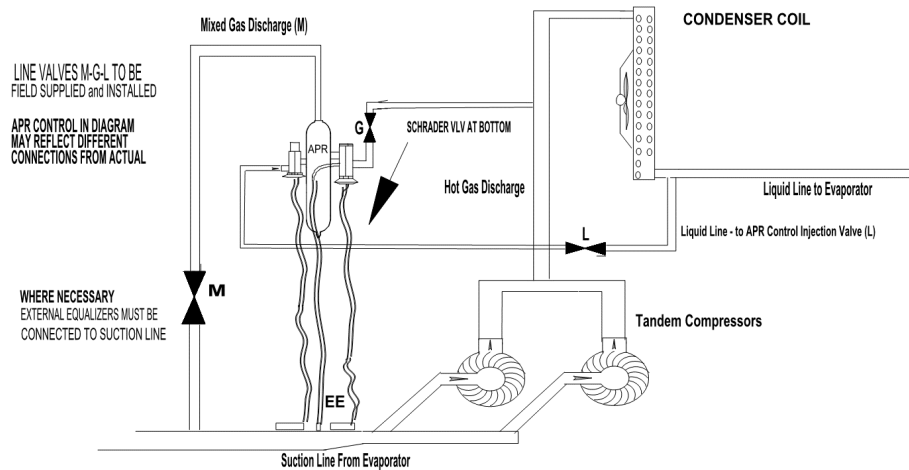
- A. Airex Manufacturing Inc.; AIREX TITAN OUTLET, or equal Wall Outlet seal. Provided and installed with its compression gasket mounting method and must be fastened to wall surface with supplied ICC-ES listed and approved non-corrosive screws with pre-loaded neoprene washers. Wall Outlet must also integrate an over-molded, flexible, elastomeric sleeve for sealing, supporting and isolating refrigerant pipes to also control vibration. The Wall Outlet shall also feature outdoor-rated durability and shall provide wall expansion and contraction protection features achieved by gaskets and seals as per energy code requirements. A stainless-steel clamp must be utilized to create a "Mechanical Connection" between wall seal and pipe insulation protector as intended per energy codes to allow removable/reusable maintenance capabilities and designed to co-act with a pipe insulation jacketing. Wall Outlet seal and insulation protector must both be sustainably and securely installed, mechanically fastened together as one, due to piping vibration, and shall be assembled without the use of adhesives or adhesive tapes as per energy code requirements. Wall Outlet tested in accordance with: ASTM E 331 (Water Penetration), ASTM E 283 (Air Leakage), and ASTM E 2178 - Air Permeance of Building Materials.
- B. Provide the appropriate Wall Outlet type/size for construction type and pipe/insulation sizes, multiple variations are available from the manufacturer.
- C. Provide a Wall Outlet at each refrigerant piping envelope penetration.

2.05 REFRIGERANT

- A. Provide full refrigerant charge in accordance with HVAC unit manufacturers instructions.

2.06 APR CONTROL

- A. APR Controls, as manufactured by Rawal Devices, Inc., shall be provided to provide continuous capacity modulation on the refrigeration circuits of the unit for additional capacity control during part load conditions.
- B. Control is to be installed in the condensing section in accordance with Rawal Devices, Inc. installation instructions or the direction of Rawal Devices, Inc. ASHRAE refrigeration piping and Equipment Manufacturer's piping protocol must be adhered to.
- C. Provide ball valves on all connections to the APR control device to allow for isolation of the APR control during charging and start up.



PART 3 - EXECUTION

3.01 VALVE AND SPECIALTY APPLICATIONS

- A. Provide refrigerant specialties in accordance with HVAC unit manufacturers requirements.
- B. Provide thermostatic expansion valves as close as possible to distributors on evaporators.
- C. Provide moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

3.02 PIPING INSTALLATION

- A. Refer to Division 23 Section "Common Work Results" for installation of:
 1. Basic piping requirements.
 2. Joint construction requirements.
 3. Hanger, support, and anchor devices.
 4. Firestopping
 5. Sleeves and Escutcheons
 6. Mechanical Identification
- B. Provide piping layout, fittings, valves, and specialties in accordance with the HVAC unit manufacturer's instruction.
- C. Provide roof piping penetrations as per Section 23 05 00
- D. Provide insulated refrigerant piping per Section 23 07 00 and HVAC unit manufacturer's recommendations.
- E. Provide refrigerant piping according to ASHRAE 15 and governing codes.
- F. Provide piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

1. In rooms without ceiling, arrange piping and tubing, controls, and electrical power serving units to provide a neat and finished appearance. Provide piping at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
 2. In rooms with ceilings, conceal piping and tubing, controls, and electrical power serving units above ceilings. Provide piping above accessible ceilings to allow sufficient space for ceiling panel removal. Diagonal runs are allowed to reduce refrigerant pipe length.
- G. Provide piping adjacent to machines to allow service and maintenance.
- H. Provide fittings for changes in direction and branch connections.
- I. Provide piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- J. Arrange piping to allow inspection and service of refrigeration equipment. Provide valves and specialties in accessible locations to allow for service and inspection.
- K. Provide piping free of sags and bends. Unless otherwise required by HVAC unit manufacturer, slope refrigerant piping and tubing as follows:
1. Provide horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
 2. Provide horizontal suction lines with a uniform slope downward to compressor.
 3. Provide traps and double risers to entrain oil in vertical runs.
 4. Liquid lines may be installed level.
- L. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- M. Provide piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- N. Provide and connect pre-charged refrigerant tubing to component's quick-connect fittings. Provide tubing to allow access to unit.
- O. Refrigerant Tubing Kits:
1. Unroll and straighten tubing to suit installation. Deviations in straightness of exposed tubing shall be unnoticeable to observer.
 2. Support tubing using hangers and supports indicated at intervals not to exceed 5 feet. Minimum rod size, 1/4 inch.
 3. Prepare tubing ends and make mating connections to provide a pressure tight and leak-free installation.

3.03 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Before installation, clean piping, tubing, and fittings to cleanliness level required by HVAC unit manufacturer.
- C. Ream ends of tubes and remove burrs. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

- D. Joining method shall be approved by HVAC unit manufacturer.
1. Brazed Joints:
 - a. Construct joints in accordance with AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
 - b. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze.
 - c. The piping being brazed shall be purged of air to remove the oxygen and filled with one of the following inert gases: oxygen-free nitrogen, helium or argon. The piping system shall be purged with an inert gas for a minimum time corresponding to five volume changes through the piping system prior to brazing. The pre-purge rate shall be at a minimum velocity of 100 feet per minute (0.508 m/s). The inert gas shall be directly connected to the tube system being brazed to prevent the entrainment of ambient air. After the pre-purge, the inert gas supply shall be maintained through the piping during the brazing operation at a minimum pressure of 1.0 psi and a maximum pressure of 3.0 psi. The joint shall be brazed with a filler metal conforming to AWS A5.8.
 2. Mechanically Pressed Joints
 - a. The installing contractor shall be fully trained and qualified by the manufacturer of the mechanically pressed joints to install the selected piping connections.
 - b. Mechanical joints shall be installed in accordance with the manufacturer's instructions.
 3. Flared Joints: Flared fittings shall be installed in accordance with the manufacturer's instructions. The flared fitting shall be used with the tube material specified by the fitting manufacturer. The flared tube end shall be made by a tool designed for that operation.

3.04 APR VALVE

- A. Pump down system and lock existing refrigerant in the receiver or condenser. If you cannot secure existing system charge, use proper refrigerant recovery methods to save and store the refrigerant charge. Before installing the APR Control make sure the system is clean –if not, or in doubt a new filter / strainer must be used to protect the APR Control to isolate and remove the system contaminants. Particles of dirt can settle on the valve seat of the hot gas bypass valve and prevent it from closing, leading to possible compressor overheating and system damage.
- B. After installation, use standard evacuation procedures. Connections between the system and the APR Control can be made in the condensing section. The APR Control may be mounted outside the condensing unit housing if space or access are a problem. The APR Control shall be mounted vertical, with discharge from the de-superheating chamber up, or an orientation so chamber discharge is above Schrader valve at bottom. Manual Shut off valves to isolate the APR Control connections to liquid, hot gas and suction lines shall be provided.
- C. Connections to the refrigerant circuit can be on horizontal or vertical pipes, but discharge from the APR Control de-superheating chamber to the suction line must be into the top of the suction line to prevent oil from draining into the APR Control chamber.
- D. Connections to the APR Control shall be made with Stay-Silv® 15 or equivalent Brazing Alloy.

3.05 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.

B. Refrigerant Tubing Positive Pressure Testing:

1. Comply with more stringent of HVAC unit manufacturer's requirements and requirements indicated.
2. After completion of tubing installation, pressurize tubing systems to a test pressure of not less than 1.5 times HVAC system operating pressure, but not less than 600 psig, using dry nitrogen.
3. Successful testing shall maintain a test pressure for a continuous and uninterrupted period of 24 hours. Allowance for pressure changes attributed to changes in ambient temperature are acceptable.
4. Prepare test report to record the following information for each test:
 - a. Name of person starting test, company name, phone number, and e-mail address.
 - b. Name of manufacturer's service representative witnessing test, company name, phone number, and e-mail address.
 - c. Detailed description of extent of tubing tested.
 - d. Date and time at start of test.
 - e. Test pressure at start of test.
 - f. Outdoor temperature at start of test.
 - g. Name of person ending test, company name, phone number, and e-mail address.
 - h. Date and time at end of test.
 - i. Test pressure at end of test.
 - j. Outdoor temperature at end of test.
 - k. Remarks:
5. Submit test reports for Project record.

C. Refrigerant Tubing Evacuation Testing:

1. Comply with more stringent of HVAC unit manufacturer's requirements and requirements indicated.
2. After completion of tubing positive-pressure testing, evacuate tubing systems to a pressure of 500 microns.
3. Successful testing shall maintain a test pressure for a continuous and uninterrupted period of one hour(s) with no change.
4. Prepare test report to record the following information for each test:
 - a. Name of person starting test, company name, phone number, and e-mail address.
 - b. Name of HVAC unit manufacturer's service representative witnessing test, company name, phone number, and e-mail address.
 - c. Detailed description of extent of tubing tested.
 - d. Date and time at start of test.
 - e. Test pressure at start of test.
 - f. Outdoor temperature at start of test.
 - g. Name of person ending test, company name, phone number, and e-mail address.
 - h. Date and time at end of test.

- i. Test pressure at end of test.
 - j. Outdoor temperature at end of test.
 - k. Remarks:
 - 5. Submit test reports for Project record.
 - 6. Upon successful completion of evacuation testing, system shall be charged with refrigerant.
- D. System Refrigerant Charge:
- 1. Using information collected from the refrigerant tubing evacuation testing, system Installer shall consult HVAC unit manufacturer to determine the correct system refrigerant charge.
 - 2. Installer shall charge system following HVAC unit manufacturer's written instructions.
 - 3. System refrigerant charging shall be witnessed by HVAC unit manufacturer's representative.
 - 4. Total refrigerant charge shall be recorded and permanently displayed at the system's outdoor unit.

3.06 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of controllers to the system design temperature.

END OF SECTION

SECTION 23 31 13

DUCTWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 8 for Access Doors
 - 2. Division 23 Section "Common Work Results"
 - 3. Division 23 Section "Air Terminals"
 - 4. Division 23 Section "Diffusers, Registers, and Grilles."
 - 5. Division 23 Control Section
 - 6. Division 23 Section "Testing, Adjusting, and Balancing"
 - 7. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. This Section includes ductwork and accessories.

1.03 SYSTEM DESCRIPTION

- A. Drawings show the general layout of ductwork and accessories but do not show all required fittings and offsets that may be necessary to connect ducts and to coordinate with other trades. Fabricate ductwork based on field measurements. Provide necessary fittings and offsets. Coordinate with other trades for space available and relative location of HVAC equipment and accessories on ceiling grid. Duct sizes on the drawings are inside dimensions, which may be altered by Contractor to other dimensions with the same air handling characteristics where necessary to avoid interferences and clearance difficulties.
- B. The contractor must comply with the enclosed specification in its entirety. If on inspections, the engineer finds changes have been made without prior written approval, the contractor will make the applicable changes to comply with this specification, at the contractor's expense.
- C. At the discretion of the engineer, sheet metal gauges, and reinforcing may be randomly checked to verify duct construction is in compliance.

1.04 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", 4th Edition (SMACNA); and performance requirements and design criteria indicated in "Duct Schedule" Article.

- B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1. Exception: Sheet metal surfaces and fasteners.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:
 - 1. Liners and adhesives.
 - 2. Sealants and gaskets.
- B. Shop Drawings:
 - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - 2. Factory- and shop-fabricated ducts and fittings.
 - 3. Fittings.
 - 4. Reinforcement and spacing.
 - 5. Seam and joint construction.
 - 6. Penetrations through fire-rated and other partitions.
 - 7. Equipment installation based on equipment being used on Project.
 - 8. Hangers and supports, including methods for duct and building attachment.
- C. Delegated-Design Submittal:
 - 1. Sheet metal thicknesses.
 - 2. Joint and seam construction and sealing.
 - 3. Reinforcement details and spacing.
 - 4. Materials, fabrication, assembly, and spacing of hangers and supports.
- D. Ductwork Specialties Product Data; provide for the following:
 - 1. Sealant
 - 2. Duct Liner
 - 3. Duct-mounted access doors and panels.
 - 4. Flexible ducts.
 - 5. Manual-volume dampers: Damper manufacturer's printed application and performance data including pressure, velocity and temperature limitations shall be submitted for approval.
 - 6. Life Safety dampers: Provide complete submittal information (including installation instructions) and the manufacturer's certification of compliance with these specifications for approval prior to bidding. Contractor shall include damper manufacturer's Installation Instructions as part of the submittal. These instructions shall describe the applicable requirements for damper sleeve thickness, retaining angles, and methods of attachment, duct-to-sleeve connections, preparation of wall or floor openings, and all other requirements to provide an installation equivalent to that tested by the damper manufacturer during the UL Standard 555 qualification procedures. Contractor shall detail any proposed installations that deviate from these manufacturer's instructions and explain the needed deviations.
 - 7. Duct Silencers: The manufacturer shall supply certified test data for each scheduled silencer. The data shall include dimensions, weights, dynamic insertion loss, generated noise and pressure drop for forward or reverse flow, matching the project's air distribution system requirement. All ratings shall be conducted in the same facility and shall utilize the same silencer. Silencer performance must have been substantiated by laboratory testing according to ASTM E-477-99 and so certified when submitted for approval.

8. Louvers: Provide data describing design characteristics, maximum recommended air velocity, design free area, AMCA seals, materials and finishes. Provide independent agency reports showing compliance with specified performance criteria. For units with factory-applied color finishes, provide color chart.
9. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.

1.06 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: 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. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
 2. Suspended ceiling components.
 3. Structural members to which duct will be attached.
 4. Size and location of initial access modules for acoustical tile.
 5. Penetrations of smoke barriers and fire-rated construction.
 6. Items penetrating finished ceiling – examples: lighting fixtures, sprinklers, etc.
 7. Areas of building where coordination drawings are required:
 - a. All Mechanical Rooms
 - b. All ductwork 24" wide and larger.
 - c. Congested areas
- B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- C. Record Drawings: Indicate actual routing, fitting details, reinforcement, support, and installed accessories and devices.

1.07 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.08 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
- C. IMC-2021
- D. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
 1. 4th Edition: 2020 HVAC Duct Construction Standards, Metal and Flexible (SMACNA)
 2. 1st Edition: 2012 ANSI/SMACNA 016-2012 HVAC Air Duct Leakage Test Manual

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sealant and fire stopping materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.
- B. Deliver, store and handle materials according to manufacturer's written recommendations.
- C. All ductwork, equipment, and fittings delivered and stored on the job site must be capped to prevent the entry of moisture, construction dust or other debris.

PART 2 - PRODUCTS

2.01 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M. Galvanized Coating Designation: G60 or G90 as indicated. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Carbon-Steel Sheets: Comply with ASTM A 1008/A-1008M, with oiled, matte finish for exposed ducts.
- D. Stainless-Steel Sheets: Comply with ASTM A-480/A-480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be as indicated in the "Duct Schedule" Article.
- E. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- F. Reinforcement Shapes and Plates: ASTM A-36/A-36M, steel plates, shapes, and bars; black and galvanized.
- G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.02 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA.
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA.

- D. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of un-braced panel area, unless ducts are lined. All large ducts must be braced as required to prevent drumming.
- E. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA.
 - 1. Fig. 2-3 Rectangular Elbows: Type RE2 square throat with vanes, Type RE1 radius (1.5W minimum), or Type RE5 dual radius. Square throat is not allowed.
 - 2. Vane support in elbows: Fig 2-4. Turning vanes shall be double wall turning vanes fabricated from the same material as the duct. Mounting rails shall have friction insert tabs that align the vanes automatically. Tab spacing shall be as specified in Figure 2-3 of SMACNA. Rail systems with non-standard tab spacing shall not be accepted. Due to tensile loading, vanes shall be capable of supporting 250 pounds when secured according to the manufacturer's instructions.
 - 3. Fig. 2-5 Rectangular Divided Flow Branches: Type 1, Type 2, Type 4A, or 4B.
 - 4. Fig. 2-6 Branch Connections: 45-degree entry, 45-degree lead-in, bell-mouth or spin-in (single diffuser supply only).
 - 5. Fig. 2-7 Offsets and Transitions. Use gradual offsets as shown, 90-degree offsets shall be avoided.
 - 6. Fig 2-9 Duct Coils: Duct coils with transitions and upstream access door.

2.03 ROUND DUCT FABRICATION

- A. Fabricate supply ducts of galvanized steel according to SMACNA.
- B. Longitudinal Seams: Select seam types and fabricate according to SMACNA Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA.
 - 1. Exposed Round Ducts: Shall be Spiral Seam (RL-1 seam) at 2-inch wg construction.
 - 2. Concealed Round Ducts: Shall be longitudinal Grooved Seam Flat lock (RL-5 seam) at 2-inch wg construction.
 - 3. Snap lock seams shall not be used for this project.
- C. Transverse Joints: Select joint types and fabricate according to SMACNA Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA.

2.04 HANGERS AND SUPPORTS

- A. Hanger Rods: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Outdoor 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 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. 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.
- E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- F. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.
- G. Supports For Roof Mounted Items:
 - 1. Equipment rails shall be galvanized steel, minimum 18-gauge, with integral baseplate, continuous welded corner seams, factory installed 2x4 treated wood nailer, 18-gauge galvanized steel counter flashing cap with screws, built-in cant-strip; minimum height 11 inches. Provide raised cant strip to start at the upper surface of the insulation.
 - 2. Roof Duct Supports: Portable Pipe Hanger Model number PPH-D - Enclosed style.
 - a. Engineered, portable system specifically designed for installation without the need for roof penetrations or flashings, and without causing damage to the roofing membrane.
 - b. Hot dip galvanize in accordance with ASTM A 123 after fabrication.
 - c. Factory fabricated to support exact duct sizes and equipment to be installed.
 - d. Provide SS or galvanized clamps, bolts, nuts, washers, and other devices as required for a complete system.

2.05 SEALANT MATERIALS

- A. Joint Sealant/Mastic: Shall be flexible, water-based, adhesive sealant designed for use in all pressure duct systems. After curing, it shall be resistant to ultraviolet light and shall prevent the entry of water, air and moisture into the duct system. Sealer shall be UL 723 listed; UL 181A-M or 181B-M listed; and meet NFPA 90A requirements. Pressure sensitive tape shall not be used as a sealing mechanism.
 - 1. Maximum 5 flame spread and 0 smoke-developed (ASTM E-84 Tunnel Test).
 - 2. Generally, provide liquid sealant for low clearance slip joints and heavy, permanently elastic, mastic type where clearances are larger.
 - 3. Resistance to mold, mildew and water: Excellent
 - 4. Color: Gray
 - 5. Duct sealant/mastic shall meet requirements for LEED. ITW TACC Miracle Kingco water-based sealants, or approved equal.
- B. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- C. Round Duct Joint O-Ring Seals: Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch w.g. and shall be rated for 10-inch w.g. static-pressure class, positive or negative. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.06 SEISMIC-RESTRAINT DEVICES

- 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. Ductmate Industries, Inc.
 3. Hilti Corp.
 4. Kinetics Noise Control.
 5. Mason Industries.
 6. TOLCO; a brand of NIBCO INC.
 7. Unistrut Corporation; Tyco International, Ltd.
- 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, ASCE/SEI 7, and SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
- C. 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. 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.
- D. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.
- E. 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.
- F. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod.
- G. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.07 FITTINGS

- A. Tees, Laterals, and Conical Tees: Use 45 degree; fabricate to comply with SMACNA with metal thicknesses specified for longitudinal seam straight duct.
- B. Diverging-Flow Fittings: Fabricate with a reduced entrance to branch taps with no excess material projecting from body onto branch tap entrance.
- C. Elbows: Diameters 3 through 8 inches shall be two-section die stamped; all others shall be gored construction, maximum 18 degree angle, with all seams continuously welded or standing seam. Coat galvanized areas of fittings damaged by welding with corrosion resistant aluminum paint or galvanized repair compound.
- D. Low-point drains: Ductmate moisture drain with funnel collection design; 3/4" connection with drain fitting and cap.

2.08 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
 2. Greenheck Fan Corporation.
 3. McGill Air Flow LLC.
 4. Nailor Industries Inc.
 5. Durodyne
 6. Cesco
 7. Buckley
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."
1. Door: Double wall, rated for up to 4.5" static pressure. Door panel filled with 1" fiberglass insulation; ¾ lb. density. Hinges and Latches: 1-by-1-inch continuous piano hinge and cam latches. Fabricate doors airtight and suitable for duct pressure class.
 2. Frame: Galvanized sheet steel, with bend-over tabs.
 3. Provide 1/8" thick neoprene gaskets.
 4. Locks: Access doors less than 12 sq. inches: One cam lock. Doors over 12 sq. inches shall have two locks.
- C. Grease Duct Access Doors: Ductmate Grease Duct Sandwich Access Door or approved equal; two layers of precision stamped, hot-dipped galvanized steel, and one 16 gauge black iron backing plate. Doors shall be tested to -20" W.C. with no leakage noted. The backing plate shall be spot welded to the inside panel. Gasket: Ceramic Fiber Gasket (2300°F max—meets NFPA 96 standards) shall be permanently bonded to the outside panel of the access door to eliminate leakage. Zinc plated conical springs shall be installed between the inner and outer door, to facilitate opening. Provide zinc coated wing nuts for access; zinc plated carriage bolts, welded and sealed to the inner door. Provide a self adhesive template for the exact size of duct opening required.

2.09 FLEXIBLE CONNECTORS

- A. Provide for all air moving equipment. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with NFPA 90A. Factory fabricated with a strip of fabric 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized, sheet steel or 0.032-inch aluminum sheets. Select metal compatible with connected ducts. Duro-Dyne, Ductmate, Hardcast, or approved equal.
- B. Indoor Flexible Connector Fabric: Glass fabric double coated with polychloroprene or neoprene. Minimum Weight: 26 oz. /sq. yd. Tensile Strength: 480 lbf/inch in the warp, and 360 lbf/inch in the filling.
- C. Outdoor Flexible Connector Fabric: Glass fabric double coated with a synthetic-rubber or hypalon, white color; weatherproof coating resistant to the sun's ultraviolet rays and ozone environment. Minimum Weight: 24 oz. /sq. yd. Tensile Strength: 530 lbf/inch in the warp, and 440 lbf/inch in the filling.

2.10 FLEXIBLE DUCTS

- A. General: Comply with UL 181, Class 0 or 1. Flame Spread: Less than 25; Smoke Developed: Less than 50.
- B. All products shall be certified by Greenguard Environmental Institute; independent testing of products for emissions of respirable particles and Volatile Organic Compounds (VOC's), including formaldehyde and other specific product-related pollutants. Greenguard provides independent, third-party certification of IAQ performance. Certification is based upon criteria used by EPA, OSHA and WHO.
- C. Rated Positive Pressure: 10" w.g. per UL-181. Maximum negative pressure: $\frac{3}{4}$ ".
- D. Flexible Ducts, Insulated: Factory-fabricated, insulated, round duct, with an outer jacket enclosing glass-fiber insulation around a continuous inner liner.
 - 1. R6 insulation, Basis of Design: Atco #86
 - 2. Reinforcement: Steel-wire helix encapsulated in inner liner.
 - 3. Jacket (inner and outer): Polyethylene film.
- E. Exhaust/Return Flexible Ducts, not insulated: Atco#50 Factory-fabricated, round duct. Reinforcement: Triple lamination of tough metallized polyester, aluminum foil and polyester encapsulates a steel wire helix. Rated for $\frac{3}{4}$ " w.g. negative pressure.
- F. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches to suit duct size.
- G. Hangers shall be band type, 1" wide minimum.

2.11 MANUAL-VOLUME DAMPERS

- A. Manual balancing dampers meeting the following specifications shall be furnished and installed on all branch ducts and where shown on plans. Testing and ratings to be in accordance with AMCA Standard 500-D.
- B. Single-Blade Rectangular Dampers shall consist of: an 18 ga. galvanized steel frame with 3-1/2 in. depth; blades fabricated from 20 ga. galvanized steel; integral 1/2 in. diameter axles. Damper suitable for pressures to 1.0 in. wg, velocities to 2000 fpm and temperatures to 180°F. Basis of design is Greenheck model MBD-10.
- C. Multi-Blade Rectangular Dampers shall consist of: a 16 ga. galvanized steel hat channel frame with 5 in. depth; triple V type blades fabricated from 16 ga. galvanized steel; 1/2 in. dia. plated steel axles; external (out of the airstream) blade-to-blade linkage. Damper suitable for pressures to 4.0 in. w.g. (996 Pa), velocities to 2000 fpm and temperatures to 180°F. Basis of design is Greenheck model MBD15.
- D. Round dampers shall consist of: a 20 ga. galvanized steel frame with 6 in. depth; blades fabricated from 20 ga. galvanized steel; 3/8 in. square plated steel axles turning in acetal bearings. Damper suitable for pressures to 1.0 in. wg, velocities to 2000 fpm and temperatures to 180°F. Basis of design is Greenheck model MBDR50.

2.12 REMOTE DAMPER OPERATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Pottorff
 - 2. Ventfabrics, Inc.
 - 3. Young Regulator Company.
- B. Ratings: Temperature Rating: -25°F to 180°F; Air Flow Rating: 1,500 fpm; Differential Pressure Rating: 1 in. wg.
- C. Construction:
 - 1. Basis of Design: Pottorff Model RCS-10 (rectangular); RCS-10R (round)
 - 2. Frame: 6" x minimum 22-gauge, roll formed galvanized steel with reinforcing beads at each end.
 - 3. Blade: Round, minimum 22-gauge, galvanized steel with center formed V for added rigidity. Flat blades are not acceptable.
 - 4. Axles: Minimum 3/8" square plated steel, mechanically attached to blade. Bearings: Molded synthetic, sleeve-type turning in tight sealing hole in frame.
 - 5. Mounting: Vertical and/or Horizontal
 - 6. Actuator: Remote cable-controlled quadrant shall be factory installed to the damper, attached to a minimum 36-inch-long flexible cable controlled, and controlled by a 3/16-inch Allen hex-head drive with 15/16 inch round white finishing plug (suitable for painting) and integral side-mounting flange. The entire assembly shall be factory assembled and tested prior to shipment; field assembled systems are not acceptable.
 - 7. Finish: Mill galvanized.

2.13 FIRE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Air Balance Inc.
 - 2. Cesco Products
 - 3. Greenheck Fan Corporation.
 - 4. Metalaire, Inc.
 - 5. Nailor Industries Inc.
 - 6. Prefco
 - 7. NCA
 - 8. Ruskin Company.
- B. Type: Static; rated and labeled according to UL 555S by an NRTL.
- C. Fire Rating: 1-1/2 hours.
- D. Frame: Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.
- E. Mounting Sleeve: Factory-provided.
- F. Mounting Orientation: Vertical or horizontal as indicated.

- G. Blades: Roll-formed, interlocking, 0.034-inch-thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.
- H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- I. Heat-Responsive Device: Provide replaceable fusible links with a temperature approximately 50°F above the maximum temperature that would normally be encountered within the system, but not less than 165°F.
- J. Provide the grille option for curtain style fire dampers provides mounting flanges on the sleeve to ease installation of grilles in the field (Grilles specified in Section 23 37 13). The flanges shall be made out of 20 gauge galvanized steel (3/4 inch x 2 in. long) with .149 in. diameter hole for fastening of grille. The flanges are concealed when the grille is installed.

2.14 SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Air Balance Inc.
 - 2. Cesco Products
 - 3. Greenheck Fan Corporation.
 - 4. METALAIRE, Inc.
 - 5. Nailor Industries Inc.
 - 6. Prefco
 - 7. Ruskin Company.
- B. Dampers shall have a:
 - 1. UL555S leakage rating of Leakage Class I.
 - 2. 555S elevated temperature rating of 350°F.
 - 3. Minimum UL 555S differential pressure rating of 4 in. w.g.
 - 4. Minimum UL 555S velocity rating of 2000 fpm
- C. Linkage shall be concealed in jamb.
- D. Mounting Sleeve: Factory-installed, 0.039-inch thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone caulking.
- E. Smoke Detector: No flow smoke detector shall be rated for air velocities 0 – 3000 fpm; low profile photoelectric smoke detector listed to UL 268A specifically for use in no flow or low flow air handling systems.
- F. Fire/Smoke Dampers: Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.
- G. Damper Actuator - Electric:
 - 1. UL 873, plenum rated.
 - 2. Designed to operate in smoke-control systems complying with UL 555S requirements.
 - 3. Two-position with fail-safe spring return.
 - 4. Actuator shall be externally factory mounted and provided with single-point wiring connection.

- H. Provide breakaway connection, sleeve, and other components as per manufacturers recommendations for a code compliant installation.
- I. Provide accessories:
 - 1. Auxiliary switch for position indication.
 - 2. Test and reset switches, remote mounted.
 - 3. Momentary test switch to enable easy maintenance and inspection by allowing the dampers to be tested and cycled by one person right at the damper location by simply holding the test switch down.

PART 3 - EXECUTION

3.01 DUCT INSTALLATION, GENERAL

- A. Provide volume dampers at branch ducts to RGD's. If volume dampers are inadvertently not shown, contractor shall provide, the intent is to provide volume dampers at branches.
- B. Provide ducts and accessories according to SMACNA unless otherwise indicated.
- C. Construct and install each duct system for the specific duct pressure classification indicated.
- D. Properly seam, brace, stiffen, support and render ducts mechanically airtight. Adjust ducts to suit job conditions. Dimensions may be changed as approved, if cross sectional area is maintained.
- E. Provide ducts in lengths not less than 12 feet, unless interrupted by fittings. Provide ducts with fewest possible joints.
- F. Provide fabricated fittings for changes in directions, changes in size and shape, and connections.
- G. Provide couplings tight to duct wall surface with a minimum of projections into duct.
- H. Provide ductwork to allow maximum headroom. Provide ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs. Provide ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- I. Provide ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- J. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions, unless specifically indicated.
- K. Coordinate layout with suspended ceiling, lighting layouts, and similar finished work.
- L. Electrical Equipment Spaces: Ductwork not allowed.
- M. Exterior ductwork shall have a pitch of at least 3 degrees on the top, to allow water runoff, prevent ice buildup.

3.02 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Hangers Exposed to View: Threaded rod and angle or channel supports.
- C. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system. Seal duct joints to prevent dirt marks.
- D. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- E. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- F. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.03 MATERIALS

- A. Hangers, accessories, and dampers shall be same material as parent duct.
- B. Ducts shall be G60 galvanized steel except as follows:
 - 1. Un-insulated exterior ductwork: G90 galvanized steel.
 - 2. Exterior ductwork: Hangers and attachments shall be electro-galvanized, all-thread rod or galvanized rods with threads painted after installation. Refer to SMACNA Fig. 5-3. Ductwork shall be pitched or sloped to prevent "ponding" of water.
 - 3. Swimming Pool (natatorium) ductwork: Aluminum, water-tight.
 - 4. Plenums at outside louvers: G90 galvanized steel; horizontal ducts connected to louver shall be water-tight and pitch to drain into the louver plenum. Louver plenum shall be water-tight, pitched to drain to exterior. Provide low-point drain fittings at low points.
 - 5. Locker Room Shower area exhaust ductwork: Aluminum
 - 6. Radon exhaust: See 221216.
- C. Painted Exposed Ducts
 - 1. Painting shall be by Division 09.
- D. Painted Exposed Ducts
 - 1. Remove dirt, grease, and manufacturing lubricant, with a non-hydrocarbon cleaner such as Simple Green. Wipe the duct dry with a clean dry cloth before painting.
 - 2. Paint ductwork with a paint suitable for hot dipped galvanized surfaces; Sherwin Williams Waterborne Acrylic Dryfall (B42W series), or equal. Following the paint manufacturer's recommendations.

3.04 DUCT CLASSIFICATIONS AND SEALING

- A. Static-Pressure Classifications: Unless otherwise indicated, construct ducts to the following:
1. Supply duct upstream of VAV terminal units: 3 in. w.g.
 2. Supply Ducts downstream of VAV terminal units: 2-inch w.g.
 3. Supply Ducts: 2-inch w.g.
 4. Supply Ducts: 3 in. w.g.
 5. Return Ducts: 2-inch w.g, negative pressure.
 6. Exhaust Ducts: 2-inch w.g, negative pressure.
 7. Rooftop air handlers and RTU's: The first 20 feet of ductwork (supply and return) shall be fabricated and installed in a stiff and rigid manner, with cross bracing for minimal "drumming"; minimum 6-inch pressure class.
- B. Seam And Joint Sealing:
1. Ductwork and plenums with pressure class ratings shall be constructed to Seal Class A. Openings for rotating shafts shall be sealed with bushings or other devices that seal off air leakage.
 2. Pressure-sensitive tape shall not be used as the primary sealant unless it has been certified to comply with UL-181A or UL-181B by an independent testing laboratory, and the tape is used in accordance with that certification.
 3. Connections shall be sealed, including but not limited to spin-ins, taps, other branch connections, access doors, access panels, and duct connections to equipment. Sealing that would void product listings is not required.
 4. Spiral lock seams need not be sealed.
 5. Seal externally insulated ducts before insulation installation.

3.05 DUCT PENETRATIONS

- A. Fire or Smoke Rated Penetrations not requiring a fire and/or smoke damper: Where ducts pass through walls, floors, or partitions that are required to have a fire resistance rating and fire dampers are not required, the opening in the construction around the duct shall be provided in accordance with the UL listing of the penetration. Provide firestopping per Section 23 05 00.
- B. Fire or Smoke Rated Penetrations: Provide fire and/or smoke damper.
- C. Non-Fire-Rated Exposed Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same metal thickness as duct. Overlap opening on four sides by at least 1-1/2 inches.
- D. Non-Fire-Rated Concealed Penetrations: Provide insulation infill and acoustical sealant around gaps. Tightly seal to prevent sound transmission. Neatly finish.
- E. Mechanical room floor penetrations: Provide 4-inch high concrete curbs or other sealing method to prevent leakage from mechanical room into floor penetration.
- F. Roof penetrations by ducts shall use counter-flashed curbs.
- G. Flexible air ducts or connectors shall not pass through any wall, floor, or ceiling.

3.06 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA Chapter 5, "Hangers and Supports."
- B. Building Attachments: Comply with SMACNA Chapter 5, "Hangers and Supports". Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
- C. Hanger Spacing: Comply with SMACNA 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. 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.
- E. Provide 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.
- F. SEISMIC-RESTRAINT-DEVICE INSTALLATION
 - 1. Provide 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.
 - a. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 - b. Brace a change of direction longer than 12 feet.
- G. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.
- H. Provide cables so they do not bend across edges of adjacent equipment or building structure.
- I. Provide cable restraints on ducts that are suspended with vibration isolators.
- J. Provide seismic-restraint devices using methods approved by an evaluation service member of the ICC Evaluation Service.
- K. 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.
- L. Drilling for and Setting Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the 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. Heavy-duty sleeve anchors shall be installed 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. Provide zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.07 FLEXIBLE DUCT

- A. Provide in accordance with manufacturer's and SMACNA recommendations.
- B. Flexible ducts shall be supported at manufacturer's recommended intervals, but at no greater distance than 5 feet. Maximum permissible sag is $\frac{1}{2}$ " per foot of spacing between supports.
- C. Provide duct fully extended; do not install in the compressed state or use excess lengths.
- D. Avoid bending ducts across sharp corners or incidental contact with metal fixtures, pipes, conduits, or hot equipment.
- E. Bends shall be made with not less than 1 duct diameter centerline radius. Ducts shall extend a few inches beyond the end of a sheet metal connection before bending.
- F. Hanger or saddle material in contact with the duct shall be at least 1" wide.
- G. Provide at least 2 duct diameters of straight duct at the entrance to register, grilles, and diffusers.

3.08 DUCT ACCESSORIES INSTALLATION

- A. Provide duct accessories according to applicable details shown in SMACNA.
- B. Provide duct transitions, offsets and connections to dampers, coils, and other equipment in accordance with SMACNA Standards
- C. Each register, grille, or diffuser shall have a means of air flow adjustment. Provide volume damper in branch duct if not furnished with the RGD.
- D. Adjust operable devices for proper action.
- E. Manual dampers shall be visible outside the insulation and marked with a 12" orange ribbon.
- F. Locate each duct smoke detector in a serviceable location, in accordance with its listing.
- G. Perform the following as directed by the controls contractor: Installation of control devices. Access doors where indicated and as required.
- H. Provide duct access panels for access components that require servicing.
 1. Provide duct access panels to allow access to interior of ducts for cleaning, inspecting, adjusting, and maintaining per equipment manufacturers' requirements.
 2. Provide access panels on side of duct where adequate clearance is available.
 3. Locate panel upstream and/or downstream as recommended by manufacturer.
 4. Locations:
 - a. Upstream side of duct coils.
 - b. At outdoor-air intakes.
 - c. Adjacent to and close enough to life safety dampers, to reset or reinstall fusible links.

- d. Control devices requiring inspection.
 - e. Elsewhere as indicated or required by duct accessory manufacturer
5. Inspect locations of access doors and verify that purpose of access door can be performed.

I. Control Damper Installation

- 1. Damper submittals shall be coordinated for type, quantity, and size to ensure compatibility with sheet metal design.
- 2. Duct openings shall be free of any obstruction or irregularities that might interfere with blade or linkage rotation or actuator mounting. Duct openings shall measure $\frac{1}{4}$ in. larger than damper dimensions and shall be square, straight, and level.
- 3. Individual damper sections, as well as entire multiple section assemblies, must be completely square and free from racking, twisting, or bending. Measure diagonally from upper corners to opposite lower corners of each damper section. Both dimensions must be within $\frac{1}{8}$ in. of each other.
- 4. Follow the manufacturer's instructions for field installation of control dampers. Unless specifically designed for vertical blade application, dampers must be mounted with blade axis horizontal.
- 5. Damper blades, axles, and linkage must operate without binding. Before system operation, cycle damper after installation to ensure proper operation. On multiple section assemblies, sections must open and close simultaneously.
- 6. Provide a visible and accessible indication of damper position on the drive shaft end.
- 7. Support ductwork in area of damper when required to prevent sagging due to damper weight.
- 8. After installation of low-leakage dampers with seals, caulk between frame and duct opening to prevent leakage around perimeter of damper.

J. Fire Damper Installation

- 1. Examine areas to receive dampers. Notify the Engineer of conditions that would adversely affect installation or subsequent utilization of dampers. Do not proceed with installation until unsatisfactory conditions are corrected.
- 2. Provide dampers in accordance with manufacturer's UL Installation Instructions, labeling, and NFPA 90A at locations indicated on the drawings. Any damper installation that is not in accordance with the manufacturer's UL Installation Instructions must be approved prior to installation.
- 3. Dampers must be accessible to allow inspection, adjustment, and replacement of components. The sheet metal contractor shall furnish any access doors in ductwork or plenums required to provide this access. The general contractor shall furnish any access doors required in walls, ceilings, or other general building construction.
- 4. Provide dampers square and free from racking.
- 5. The installing contractor shall provide and install bracing for multiple section assemblies to support assembly weight and to hold against system pressure.
- 6. Do not compress or stretch the damper frame into the duct or opening.
- 7. Attach multiple damper section assemblies together in accordance with manufacturer's instructions. Provide support mullions as reinforcement between assemblies as required.
- 8. Handle dampers using the frame or sleeve. Do not lift or move dampers using blades, actuator, or jackshaft.
- 9. Provide access door, properly located for serving.
- 10. Tests and Inspections: Operate dampers to verify full range of movement and verify that proper heat-response device is installed.

- K. Smoke Damper Installation: The contractor shall coordinate smoke and smoke/fire damper installation, wiring, and checkout to ensure that these dampers function properly and that they respond to the proper fire alarm system general, zone, and/or detector trips. The contractor shall

immediately report any discrepancies to the engineer no less than two weeks prior to inspection by the code authority having jurisdiction.

3.09 PROTECTION

- A. 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."
 - 1. The HVAC system and ductwork shall be provided with protective coverings. The HVAC system includes any interior surface of the facility's air distribution system for conditioned spaces and/or occupied zones. This includes the entire duct from the points where the air enters the system to the points where the air is discharged from the system.
 - 2. The duct system shall be free of construction debris.
 - 3. The working area shall be clean, dry and the ductwork protected from dust.
 - 4. Protective coverings shall only be removed immediately before installation and inspected to determine if additional wipe down is necessary.
- B. Upon completion of installation duct systems and before HVAC system start-up, visually inspect the ductwork proper installation
- C. Cover supply openings with filter media prior to system start-up to catch any loose material that may remain inside the ductwork. Turn the HVAC system on and allow it to run until steady state operation is reached. Remove the temporary filter media from supply openings and, along with it, any loose material blown downstream and caught by the filter media.

3.10 FIELD QUALITY CONTROL

- A. Duct Leakage Tests
 - 1. Ducts and plenums designed to operate at static pressures equal to or greater than 3 inches water gauge shall be leak tested in accordance with the SMACNA HVAC Air Duct Leakage Test Manual and shown to have a rate of air leakage (CL) less than or equal to 4.0 as determined in accordance with the equation below:

$$L_{max} = C_L P^{0.65}$$

where

- L_{max} = maximum permitted leakage, cfm per 100 ft² of duct surface area
- C_L = 4, duct leakage class, cfm per 100 ft² of duct surface area per in. of water^{0.65}
- P = test pressure, which shall be equal to the design duct pressure class rating, in. of water

- 2. 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.

6. Documentation shall be furnished demonstrating that representative sections totaling not less than 25 percent of the duct area have been tested and that all tested sections comply with the requirements of this section.
7. Duct system will be considered defective if it does not pass tests and inspections.

3.11 DUCT CLEANING

- A. Ducts shall be kept clean. If the contractor fails to maintain cleanliness, duct cleaning will be required, using duct cleaning methodology as indicated in NADCA ACR.
- B. If the contractor fails to maintain cleanliness, duct system cleanliness tests shall be performed:
 1. Visually inspect duct system to ensure that no visible contaminants are present.
 2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness in accordance with "Description of Method 3 - NADCA Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
 - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media is to not exceed 0.75 mg/100 sq. cm.
 3. Duct system will be considered defective if it does not pass tests and inspections.
 4. Prepare test and inspection reports.

END OF SECTION

SECTION 23 36 00

AIR TERMINAL UNITS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 23 Section "Common Work Results"
 - 2. Division 23 Controls Section for control devices installed on air terminals.
 - 3. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. This Section includes single-duct air terminals.

1.03 ACTION SUBMITTALS

- A. 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.
 - 3. Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
 - 4. For adhesives and sealants, documentation including printed statement of VOC content.
 - 5. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals.

1.05 QUALITY ASSURANCE

- A. Product Options: Drawings and schedules indicate requirements of air terminals and are based on specific systems indicated. Other manufacturers' systems with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

- B. Listing and Labeling: Provide electrically operated air terminals specified in this Section that are listed and labeled. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.
- C. Testing Requirements: Test and rate air terminals according to ARI 880, "Industry Standard for Air Terminals."
- D. Identification: Label each air terminal with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.
- E. NFPA Compliance: Provide air terminals according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
- F. Comply with NFPA 70 for electrical components and installation.
- G. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide air terminals by one of the following:
 - 1. Titus
 - 2. Enviro Tech
 - 3. Price (Basis of Design)
 - 4. Metal Aire
 - 5. Krueger

2.02 SINGLE-DUCT AIR TERMINALS

- A. The unit casing shall be comprised of 22 gauge galvanized steel. Outlet connection shall be slip and drive. Basis of Design: Price Single-Duct SDV – With electric heating coil.
- B. Terminal units shall be ARI 880 - 98 certified and UL Listed.
- C. Casings: 22 gauge galvanized steel. Maximum casing leakage: 1.5 cfm at 1-inch w.g. inlet static pressure, certified ultra-low air leakage.
- D. 1" Double-wall Insulation—Interior surface of unit casing is acoustically and thermally lined with a 1-inch, 1.0 lb./ft³ composite density glass fiber with high-density facing. Insulation R-value is 4.1. Insulation is UL listed and meets NFPA-90A and UL 181 standards. Insulation is covered by interior liner made of 26-gage galvanized steel. All wire penetrations are covered by grommets. There are no exposed edges of insulation (complete metal encapsulation).
- E. The air inlet connection shall be an 18 gauge galvanized steel cylinder sized to fit standard round duct. A multiple point, averaging flow sensing ring shall be provided with balancing taps for measuring within +/- 5% of unit cataloged airflow. Airflow versus pressure differential calibration chart shall be provided. The damper blade shall be constructed of a closed cell foam seal mechanically locked between two 22 gauge galvanized steel disks. The damper blade assembly

shall be connected to a cast zinc shaft supported by self-lubricating bearings. The shaft shall be cast with a damper position indicator. The valve assembly shall include a mechanical stop to prevent over stroking. At 4.0" w.g. air valve leakage shall not exceed 1% of cataloged airflow.

- F. Electric Heating Coil: Factory mounted on outlet.
 - 1. Provide disconnect switch.
 - 2. SCR Control, 0-100% control range.
 - 3. Provide an airflow switch designed to disable the heater upon loss of flow.
 - 4. Provide a line safety fuse located in the line of power of the electric heater to prevent power surge damage to the electric heater.
 - 5. Provide a factory-provided door interlocking disconnect switch on the heater control panel disengages primary voltage to the terminal.
- G. Heating coils shall be provided with an access for cleaning. Provide access panels large enough for inspection, adjustment, and maintenance without disconnecting ducts, and for cleaning heating coils attached to unit Panels shall be insulated to same standards as the rest of the casing and shall be secured and gasketed airtight. It shall require no tool other than a screwdriver to remove.
- H. Controls: The terminals will have pressure independent direct digital controls supplied and mounted by the control contractor. Terminals shall be furnished with a pneumatic inlet velocity sensor. 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" wg at an inlet velocity of 500 fpm. Flow measuring taps and flow curves shall be supplied with each terminal for field balancing airflow. All pneumatic tubing shall be UL listed fire retardant (FR) type.
- I. Each terminal shall be equipped with labeling showing unit location, size, and scheduled cfm.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Provide air terminals level and plumb, according to manufacturer's written instructions, rough-in drawings, original design, and referenced standards.
- B. Allow adequate clearance to meet NEC on control box side of unit to meet NEC.
- C. Support in accordance with SMACNA and manufacturer recommendations.
- D. Connect ductwork to air terminals according to Division 23 ductwork Sections. Slip each inlet duct over the inlet collar of the terminal. Fasten and seal the connection airtight. The diameter of the inlet duct must be equal to the listed size of the terminal.
- E. Inlet and outlet duct must be installed in accordance with SMACNA guidelines. Locate air terminal units to provide a straight section of inlet duct for proper functioning of volume controls. Provide a minimum of 2.5 equivalent duct diameters of straight duct at the inlet.

3.02 CONNECTIONS

- A. Provide piping adjacent to air terminals to allow service and maintenance.
- B. Hot-Water Piping: In addition to requirements in Division 23 Section "Hydronic Piping," connect heating coils to supply with shutoff valve, strainer, and union; and to return with control valve, balancing valve and union.
- C. Electrical: Comply with applicable requirements in Division 26 Sections. Ground equipment. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.03 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.

3.04 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.

3.05 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

END OF SECTION

SECTION 23 37 13

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 23 Section "Common Work Results"
 - 2. Division 23 Section "Ductwork"
 - 3. Division 23 Section "Testing, Adjusting, and Balancing"
 - 4. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. This Section includes diffusers, registers (combination grille & damper), and grilles.

1.03 SUBMITTALS

- A. Each manufacturer shall check noise level ratings for registers and diffusers to insure that the sizes selected will not produce noise to exceed 30 db, "A" scale, measured at occupant level; notify Owner's representative of problems prior to shop drawing submittal.
- B. Pressure drop, airflow and noise criteria selection are based on design equipment. Manufacturers not submitting design makes must provide written certification in front of submittal that equipment submitted has been checked against and performs equal to the design make.
- C. Product Data: For each model indicated, include the following:
 - 1. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
 - 2. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.
 - 3. Schedule of diffusers, registers, and grilles indicating drawing designation, room location, quantity, model number, size, and accessories furnished.
 - 4. Assembly Drawing: For each type of air outlet and inlet; indicate materials and methods of assembly of components.
 - 5. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.
- D. Coordinate locations with reflected ceiling plans and wall elevations as applicable.
- E. Coordinate mounting frame with associated mounting surface.

1.04 QUALITY ASSURANCE

- A. NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A.
- B. Sound pressure levels shall be determined by using AHRI Standard 885-2008 "Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Outlets".
- C. Testing: Test performance according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 2 - PRODUCTS

2.01 GENERAL

- A. Diffusers, registers, and grilles are scheduled on Drawings.
- B. Border and mounting type shall match the mounting surface. Coordinate with mounting conditions.
- C. Material shall match the specified ductwork. Coordinate with Section 23 31 13 "Ductwork".
- D. Provide with a White Powder Coat finish, unless noted otherwise.
- E. Grille blade orientation: Vertical rectangle (wall grille with height longer than width): The blades shall run parallel to the short dimension of the grille. Horizontal rectangle: The blades shall run parallel to the long dimension of the grille.

2.02 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Price
 - 2. Titus
 - 3. Metal-Aire
 - 4. Anemostat
 - 5. Nailor

2.03 RETURN OR EXHAUST

- A. Return/Exhaust Grille, 45-degree deflection
 - 1. Material: steel (Price 530 Series) or aluminum (Price 630 Series)
 - 2. Provide damper as scheduled.
 - 3. Grilles shall be 45 degree deflection fixed louver type with blades spaced 3/4" on center.
- B. Return/Exhaust Grille, 0-degree deflection
 - 1. Material: steel (Price 510Z Series) or aluminum (Price 610Z Series)
 - 2. Provide damper as scheduled.
 - 3. Grilles shall be 0 degree deflection fixed louver type with blades spaced 3/4" on center.

C. Filter Return/Exhaust Grille.

1. Provide Price Model (530FF steel /630FF aluminum) filter return grilles.
2. Grilles shall be 45 degree deflection fixed louver type with blades spaced 3/4 inch on center.
3. The border shall be mounted to the filter frame with 1/4-turn quick-release fasteners. The mounting frame shall accept a standard 1-inch filter media. Provide MERV-5 filters.

D. Return Grille, Eggcrate.

1. Material: Aluminum (Price 85)
2. Powder coat finish.
3. 1/2 inch spacing, 45° core

2.04 SUPPLY

A. Double-deflection Supply Register

1. Material: steel (Price 520D Series) or aluminum (Price 620D Series)
2. Registers shall be double deflection type with two sets of fully adjustable deflection blades spaced 3/4" on center.
3. The integral volume control damper shall be of the opposed blade type. Material shall match the register material. The damper shall be operable from the register face.

B. Square ceiling diffusers, Fixed pattern

1. Material: steel (Price Model SCD) or aluminum (Price Model ASCD)
2. Diffusers shall consist of a precision formed back cone of one piece seamless construction which incorporates a round inlet collar of sufficient length for connecting rigid or flexible duct.
3. The diffuser shall integrate with all duct sizes shown on the plans without affecting the face size and appearance of the unit. An inner cone assembly shall consist of 3 cones (or optional 4 cones) which drop below the ceiling plane to assure optimal VAV air diffusion performance.
4. The inner cone assembly shall be completely removable from the diffuser face to allow full access to any dampers or other ductwork components located near the diffuser neck.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Provide diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.
- C. Drawings indicate general arrangement of ducts, fittings, and accessories. Make final locations where indicated, as much as practicable.

1. For units installed in lay-in ceiling panels, locate units in the center of the panel.
 2. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- D. Provide diffusers, registers, and grilles with airtight connection to ducts.
- E. Provide 18" minimum of vertical straight ductwork at the entrance to ceiling diffusers.
- F. Plenum boxes on grilles/registers shall be 8" minimum height.

3.02 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.
- B. Adjustable outlets: adjust pattern for draft-free air distribution.

3.03 CLEANING

- A. Protect unit interiors from moisture, construction debris and dust, and other foreign materials. Comply with Section 23 31 13 "Ductwork" Paragraph: Field Quality Control.
- B. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

END OF SECTION

SECTION 23 74 13
ROOFTOP AIR CONDITIONERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 23 Section Ductwork
 - 2. Division 23 Section "Common Work Results"
 - 3. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. This Section includes rooftop air conditioners, using Tempmaster as the basis of design.

1.03 ACTION SUBMITTALS

- A. Product Data:
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
 - 3. Include unit dimensions and weight.
 - 4. Include cabinet material, metal thickness, finishes, insulation, and accessories.
 - 5. Fans:
 - a. Include certified fan-performance curves with system operating conditions indicated.
 - b. Include certified fan-sound power ratings.
 - c. Include fan construction and accessories.
 - d. Include motor ratings, electrical characteristics, and motor accessories.
 - 6. Include certified coil-performance ratings with system operating conditions indicated.
 - 7. Include filters with performance characteristics.
 - 8. Include gas furnaces with performance characteristics.
 - 9. Include factory selection calculations for each antimicrobial ultraviolet lamp installation.
 - 10. Include dampers, including housings, linkages, and operators.
- B. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

1.05 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of rooftop air conditioners and are based on the specific system indicated.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."
- D. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
- E. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
- F. ARI Certification: Units shall be ARI certified and listed.
- G. Rate rooftop air-conditioner capacity according to ARI 340/360, "Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment."
- H. Sound Power Level Ratings: Comply with ARI 270, "Sound Rating of Outdoor Unitary Equipment."

1.06 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations with Division 7.

1.07 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of rooftop air conditioners that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
 - 2. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than 10 years from date of Substantial Completion.

1.08 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Filters: One set(s) of filters for each unit.

PART 2 - PRODUCTS

2.01 PACKAGED ROOFTOP UNIT

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Tempmaster
 - 2. Addison
 - 3. Rheem
- B. General: Units are convertible single packages with a common footprint cabinet and common roof curb for all 6-1/2 through 12-1/2 ton models. All have two compressors with independent refrigeration circuits to provide 2 stages of cooling. The units were designed for light commercial applications and can be easily installed on a roof curb, slab, or frame. All units are self contained and assembled on rigid full perimeter base rails allowing for 3-way forklift access and overhead rigging. Every unit is completely charged with refrigerant, wired, piped, and tested at the factory to provide a quick and easy field installation. All units are convertible between side and down airflow. Independent economizer designs are used on side and down discharge applications, as well as all tonnage sizes. Predator® units are available in the following configurations: cooling only, cooling with electric heat, cooling with gas heat, reheat only, reheat with electric heat and reheat with gas heat. Electric heaters are available as factory-installed options or field-installed accessories.
- C. Description: Units shall be factory assembled, single package, heat pump/Elec designed for outdoor installation. They shall have built in field convertible duct connections for down discharge supply/return or horizontal discharge supply/return and be available with factory installed options or field installed accessories. The units shall be factory wired, piped and charged with refrigerant and factory tested prior to shipment. All unit wiring shall be both numbered and color coded. The cooling performance shall be rated in accordance with DOE and AHRI test procedures. Units shall be CSA certified to ANSI Z21.47 and UL 1995/CAN/CSA No. 236-M90 standards.
- D. Units shall be dedicated downflow or horizontal discharge as called for on schedules and plans..
- E. Casing:
 - 1. Unit cabinet shall be constructed of galvanized steel with exterior surfaces coated with a non-chalking, powder paint finish, certified at a 750-hour salt spray test per ASTM-B117 standards. Indoor blower sections shall be insulated with up to 1" thick insulation coated on the airside. Either aluminum foil faced or elastometric rubber insulation shall be used in the unit's compartments and be fastened to prevent insulation from entering the air stream. Cabinet doors shall be hinged with toolless access for easy servicing and maintenance. Full perimeter base rails shall be provided to assure reliable transit of equipment, overhead rigging, fork truck access and proper sealing on roof curb applications. Disposable 2" filters shall be furnished as standard and be accessible through hinged access door. Fan performance measuring ports shall be provided on the outside of the cabinet to allow

accurate air measurements of evaporator fan performance without removing panels or creating bypass of the coils. Condensate pan shall be slide out design, constructed of a non corrosive material, internally sloped and conforming to ASHRAE 62-B9 standards. Condensate connection shall be a minimum of ¾" I.D. female and be rigid mount connection.

2. Unit cabinet exterior paint shall be: film thickness, (dry) 3.0 MILS minimum, gloss (per ASTM D523, 60°F / 16°C): 80+/-5, Hardness: H- 2H Pencil hardness.

F. Indoor Fan:

1. Fan shall be a belt drive assembly and include an adjustable pitch motor pulley. Job site selected brake horsepower shall not exceed the motors nameplate horsepower rating plus the service factor. Units shall be designed to operate within the service factor. Fan wheel shall be double inlet type with forward curve blades, dynamically balanced to operate smoothly throughout the entire range of operation. Airflow design shall be constant volume. Bearings shall be sealed and permanently lubricated for longer life and no maintenance. Entire blower assembly and motor shall be slide out design.
2. The evaporator coils are coated with an epoxy polymer coating to protect against corrosion.

G. Modulating Power Exhaust:

1. Power exhaust shall be used in conjunction with an integrated economizer.
2. Exhaust fans shall be of centrifugal blower design with dual exhaust fans.
3. Factory installed exhaust and field installed fold out exhaust shall achieve modulation of a irflow from the use of ECM fan motors in conjunction with monitoring the static pressure differential between the building duct and outdoor ambient pressure.
4. Bolt on field installed exhaust shall achieve modulation of airflow from the use of a Variable Frequency Drive in conjunction with monitoring the static pressure in the building duct.
5. Shall be controlled by economizer controller operation. Exhaust fans shall be energized when dampers open past the 0- 100% adjustable set point on the economizer control.
6. Factory installed exhaust shall have built in fold out rain hood design to reduce installation time.
7. Field installed exhaust shall be of bolt on design.

H. Condenser fans:

1. The outdoor fans shall be of the direct drive type, discharge air vertically, have aluminum blades riveted to corrosion resistant steel spider brackets and shall be dynamically balanced for smooth operation. The outdoor fan motors shall have permanently lubricated bearings internally protected against overload conditions and staged independently. A cleaning window shall be provided on two sides of the units for coil cleaning.
2. The condenser coils are coated with an epoxy polymer coating to protect against corrosion.

I. Refrigerant Coils, Circuit, and Safety Components:

1. Evaporator coils shall have aluminum plate fins mechanically bonded to seamless internally enhanced copper tubes with all joints brazed. Special Phenolic coating shall be available as a factory option.
2. Evaporator coils shall be of the direct expansion, draw-thru design.
3. Condenser coils shall have aluminum plate fins mechanically bonded to seamless internally enhanced copper tubes with all joints brazed or Micro-Channel aluminum tube, aluminum fins.
4. Condenser coils shall be of the draw-thru design.
5. Independent fixed-orifice or thermally operated expansion devices.
6. Solid core filter drier/strainer to eliminate any moisture or foreign matter.

7. Accessible service gage connections on both suction and discharge lines to charge, evacuate, and measure refrigerant pressure during any necessary servicing or troubleshooting, without losing charge.
 8. The unit shall have two independent refrigerant circuits, equally split in 50% capacity increments.
- J. Sloped stainless steel condensate drain pans shall be provided.
- K. Provides corrosion protection to evaporator and condenser coils for seacoast application.
1. Shall have a flexible epoxy polymer coating uniformly applied to all coil surface areas with out material bridging between fins.
 2. Coating process shall ensure complete coil encapsulation of tubes, fins and headers.
 3. Color shall be high gloss black with gloss per ASTM D523- 89.
 4. Uniform dry film thickness from 0.6 to 1.2 mil on all surface areas including fin edges.
 5. Superior hardness characteristics of 2H per ASTM 3363-00 and cross- hatch adhesion of 4B- 5B per ASTM D3359- 97.
 6. Impact resistance shall be 160 in.- lb. (ASTM D2794- 93).
 7. Humidity and water immersion resistance shall be a minimum of 1000 hours (ASTM D22 47- 99 and ASTM D870-02).
 8. Corrosion durability shall be confirmed through testing to exceed 6000 hours salt spray per ASTM B117- 97.
- L. Refrigeration System:
1. Each refrigerant circuit shall have independent fixed orifice expansion devices, service pressure ports and refrigerant line filter driers factory-installed as standard. An area shall be provided for replacement suction line driers.
 2. Compressors shall be direct-drive hermetic or scroll type compressors.
 3. The compressors have a centrifugal oil pump providing positive lubrication to moving parts. Motor shall be suction gas-cooled and shall have a voltage utilization range of plus or minus 10 percent of unit nameplate voltage. Crankcase heater, internal temperature and current-sensitive motor overloads shall be included for maximum protection. Compressors shall have internal spring isolation and sound muffling to minimize vibration transmission and noise.
 4. External high-pressure cutout and low-pressure switches shall be provided for all units.
 5. Operating range shall be between 115°F and 0°F cooling as standard from the factory for all units.
 6. Factory installed APR Rawal valve.
- M. All units shall be factory assembled, internally wired, fully charged and 100 percent run-tested before leaving the factory.
- N. Filters: 2-inch- thick, fiberglass, pleated MERV-13 filters in filter rack. Provide a factory-installed clogged-filter differential pressure switch.
- O. As Scheduled: An electric heating section, with nickel chromium elements, shall be provided in a range of 9 thru 54KW. The heating section shall have a primary limit control(s) (automatic reset) to prevent the heating element system from operating at an excessive temperature. The Heating Section assembly shall slide out of the unit for easy maintenance and service. Units with Electric Heating Sections shall be wired for a single point power supply with branch circuit fusing (where required).
1. Electric heat section shall be provided with the following minimum protections:
 - a. Primary, backup and auxiliary high temperature limit switches
- P. Economizer: The economizer is provided with a single enthalpy input. The economizer is 2% low leakage type. The economizer has spring return, fully modulating damper actuators and is

capable of introducing up to 100% outdoor air. As the outdoor air intake dampers open, the return air dampers close. The changeover from mechanical refrigeration to economizer operation is regulated by the standard single enthalpy input. There is an optional input dual dry bulb sensor available. To meet regulated air standards, the economizer control accepts an optional CO2 input for demand ventilation. With single enthalpy input, the economizer control monitors outdoor air. The dual enthalpy kit provides a second input used to monitor the return air. With a dual input kit installed, the economizer control compares the values of the two enthalpy or temperature inputs and positions the dampers to provide the maximum efficiency possible.

- Q. Unit shall be completely factory wired with necessary controls and contactor pressure lugs or terminal block for power wiring. Units shall provide an external location for mounting fused disconnect device. Microprocessor controls shall be provided for all 24-volt control functions. The resident control algorithms shall make all heating, cooling and/or ventilating decisions in response to electronic signals from sensors measuring indoor and outdoor temperatures. The control algorithm maintains accurate temperature control, minimizes drift from set point and provides better building comfort. A centralized Microprocessor shall provide anti-short cycle timing and time delay between compressors to provide a higher level of machine protection.
- R. Unit Controls:
1. Unit shall be complete with self-contained low-voltage control circuit protected by a resettable circuit breaker on the 24-volt transformer side.
 2. Unit shall incorporate a lockout circuit which provides reset capability at the space thermostat or base unit should any of the following standard safety devices trip and shut off compressor:
 - a. Loss-of-charge/Low-pressure switch.
 - b. High-pressure switch.
 - c. Freeze condition sensor on evaporator coil. If any of these safety devices trip, the LCD screen will display the alarm message.
 3. Unit shall incorporate "AUTO RESET" compressor over temperature, over current protection.
 4. Unit shall operate with conventional thermostat designs and have a low voltage terminal strip for easy hook-up.
 5. Unit control board shall have on-board diagnostics and fault message display.
 6. Standard controls shall include anti-short cycle and low voltage protection, and permit cooling operation down to a selectable value as low as 0 °F.
 7. Control board shall monitor each refrigerant safety switch independently.
 8. Shall be ASHRAE 62 compliant.
 9. Shall accept 20-30 VAC input power, 50/60Hz. 24 VAC nominal.
 10. Shall have an operating temperature range from -40°F to 158°F; 10-90% RH (non-condensing UI), and -4°F to 158°F; 10-90% RH (non-condensing), with a storage temperature range from -40°F to 194°F; 5-95% RH (non-condensing).
 11. Shall include an option of an Economizer microprocessor controller which communicates directly with the Unit Control Board and has 8 Analog outputs, 2 Analog inputs, 2 Binary outputs, 3 Binary inputs.
 12. Controller shall accept the following inputs: space temperature, return air temperature sensor, set point adjustment, outdoor air temperature, indoor air quality, outdoor air quality, indoor relative humidity, compressor lock-out, fire/smoke shutdown, single and dual enthalpy, fan status, remote time clock, Sensor Actuator (SA) Bus communicated temperature/humidity/CO2 values from Network sensors, Field Controller (FC) Bus Network Overrides for space temperature, outdoor air temperature, space humidity, outdoor air quality, Indoor air quality, System purge.
 13. Shall accept a CO2 sensor or multiple CO2 sensors networked together in the conditioned space, and be Demand Control Ventilation (DCV) ready.

14. Shall provide compressor short-cycle protection with minimum compressor runtime set at 3 minutes standard and adjustable from 2 to 7 minutes.
 15. Unit shall provide surge protection for the controller through a circuit breaker.
 16. Shall have open communication protocols with all required points exposed. Protocols supported include: BACnet®, MS/TP, Modbus®, and N2 communication.
 17. Shall have an LCD display on the Unit Control Board to display fault messages as well as navigate the menu structure to review and change set points.
 18. Shall utilize a USB connection to allow for uploading and downloading of data.
 - a. USB shall allow for downloading of “trending data” for analysis of inputs and values on other device such as a PC.
 - b. USB shall allow for uploading of new firmware to the UCB.
 - c. USB shall allow for backing up controller set points and parameters and for uploading of these same parameters to the UCB.
 19. Unit access shall include ability to view and change all adjustable parameters and set points using the same characteristics and values available directly through the UCB joystick and LCD display.
 20. Shall not require any proprietary software or contractor tool to start-up, commission and troubleshoot unit operation.
 21. Software upgrades will be accomplished by local download via USB port on main Unit Control Board.
 22. Shall be UL Recognized, File E107041, UL 916, Energy management Equipment, UL 60335-2-40, Heating and Cooling Equipment; FCC Compliant to CFR47, Part 15, Subpart B, Class B, CSA 22.2 No. 236, Signal Equipment Industry Canada, ICES-003 Recognized, and BTL certified.
 23. Shall be complete with self- contained low- voltage control circuit protected by a resettable circuit breaker on the 24- v transformer side. Transformer shall have minimum 75VA capability.
 24. Shall utilize color- coded wiring.
 25. Shall include a central control terminal board to conveniently and safely provide connection points for vital control functions such as: smoke detectors, phase monitor, gas controller, economizer, thermostat, DDC control options, and low and high pressure switches.
 26. Compressor over- temperature and over- current.
 27. Low pressure switch and high pressure switch.
 28. Low pressure switch shall use different color wire than the high pressure switch. The purpose is to assist the installer and service technician to correctly wire and or troubleshoot the rooftop unit.
 29. Automatic reset, motor thermal overload protector.
 30. Electric heat section shall be provided with the following minimum protections:
 - a. Primary, backup and auxiliary high temperature limit switches
- S. VFDs shall be factory installed and tested to provide supply fan motor speed modulation.
1. Shall be installed inside the unit cabinet, mounted, wired and tested.
 2. Shall contain Electromagnetic Interference (EMI) frequency protection.
 3. Insulated Gate Bi- Polar Transistors (IGBT) used to produce the output pulse width modulated (PWM) waveform.
 4. Built in LED display and controls. Does not require additional kit or options.
 5. RS485 capability standard.
 6. Electronic thermal overload protection.
 7. All printed circuit boards shall be conformal coated.

T. Accessories:

1. Factory installed APR rawal valve
 2. Slide-out blowers
 3. Coil coatings for evaporator and condenser coils
 4. Condensate overflow switch
 5. Enthalpy controlled bypass low leakage economizer
 6. Hail / Coil Guards
 7. Barometric Relief Damper
 8. BAS Controls
 9. VAV evaporator fan with multi-speed control
 10. VFDs
 11. Hinged access doors
 12. Disconnect Switch
 13. Dual Enthalpy sensor
 14. Modulating Power Exhaust
- U. Wiring internal to the unit shall be colored and numbered for simplified identification.
- V. Provide a UL listed phase-monitor to protect from phase loss, phase reversal, and phase unbalance. Any fault condition shall send the unit into an emergency stop condition that shall not require field adjustments for resets.
- W. Provide a factory installed thermal magnetic, molded case, HACR Circuit Breaker with provisions for through the base electrical connections. The circuit breaker shall be installed in a watertight enclosure in the unit with access through a swinging door. Factory wiring shall be provided from the switch to the unit high voltage terminal block. The circuit breaker shall provide overcurrent protection, be sized per NEC and UL guidelines, and be agency recognized by UL/CSA.
- X. Insulated Transition/Adapter Roof Curb: Provide 24" high insulated transition/ roof curb.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install units level and plumb, maintaining manufacturer's recommended clearances.
- B. Curb Support: Install roof curb on roof structure, level and secure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install and secure rooftop air conditioners on curbs and coordinate roof penetrations and flashing with roof construction. Secure units to curb support with anchor bolts.
Retain below for units mounted on isolation curbs.
- D. Isolation Curb Support: Install units on isolation curbs and install flexible duct connectors and the following vibration isolation and seismic-control devices. Flexible duct connectors are specified in Division 23 Section "Duct Accessories." Vibration isolation and seismic-control devices are specified in Division 23 Section "Mechanical Vibration and Seismic Controls."

3.02 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Install piping adjacent to machine to allow service and maintenance.
- C. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts.
- D. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
 - 1. Install ducts to termination in roof curb. Provide flexible connectors.
 - 2. Decking shall be maintained inside the RTU roof curb to a clearance of ¼" maximum around all duct drops but never contact the duct.
 - 3. Pack all air gaps around duct drops for return and supply with HUSH BATT™ and seal with HUSH SEALANT™ HSAC-100.
 - 4. The manufacturer or their local authorized agent shall inspect the in-curb deck system work on site prior to lowering of the units and issue a letter of certification stating that the products have been properly installed and sealed around all ductwork and drops to eliminate air gaps which can compromise performance.
- E. Electrical System Connections: Comply with applicable requirements in Division 16 Sections for power wiring, switches, and motor controls.

3.03 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
 - 1. Leak Test: After installation, fill water and steam coils with water and test coils and connections for leaks. Repair leaks and retest until no leaks exist.
 - 2. Charge refrigerant coils with refrigerant and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 5. Verify that specified filters are installed. Check for leakage around filters.
 - 6. Verify that cooling coil drain pans have a positive slope to drain.
 - 7. Provide cooling coil condensate drain trap and verify that it maintains an air seal.

3.04 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Complete installation and startup checks according to manufacturer's written instructions and do the following:
 - 1. Inspect for visible damage to unit casing.
 - 2. Inspect for visible damage to furnace combustion chamber.
 - 3. Inspect for visible damage to compressor, air-cooled outside coil, and fans.
 - 4. Inspect internal insulation.
 - 5. Verify that labels are clearly visible.
 - 6. Verify that clearances have been provided for servicing.

7. Verify that controls are connected and operable.
8. Verify that filters are installed.
9. Clean outside coil and inspect for construction debris.
10. Clean furnace flue and inspect for construction debris.
11. Connect and purge gas line.
12. Adjust vibration isolators.
13. Inspect operation of barometric dampers.
14. Lubricate bearings on fan.
15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
16. Adjust fan belts to proper alignment and tension.
17. Start unit according to manufacturer's written instructions.
 - a. Start refrigeration system in summer only.
 - b. Complete startup sheets and attach copy with Contractor's startup report.
18. Inspect and record performance of interlocks and protective devices; verify sequences.
19. Operate unit for an initial period as recommended or required by manufacturer.
20. Perform the following operations for both minimum and maximum firing and adjust burner for peak efficiency. Adjust pilot to stable flame.
 - a. Measure gas pressure on manifold.
 - b. Measure combustion-air temperature at inlet to combustion chamber.
 - c. Measure flue-gas temperature at furnace discharge.
 - d. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
 - e. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
21. Calibrate thermostats.
22. Adjust and inspect high-temperature limits.
23. Inspect outside-air dampers for proper stroke and interlock with return-air dampers.
24. Start refrigeration system and measure and record the following:
 - a. Coil leaving-air, dry- and wet-bulb temperatures.
 - b. Coil entering-air, dry- and wet-bulb temperatures.
 - c. Outside-air, dry-bulb temperature.
 - d. Outside-air-coil, discharge-air, dry-bulb temperature.
25. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
26. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
 - a. Supply-air volume.
 - b. Return-air volume.
 - c. Relief-air volume.
 - d. Outside-air intake volume.
27. Simulate maximum cooling demand and inspect the following:
 - a. Compressor refrigerant suction and hot-gas pressures.
 - b. Short circuiting of air through outside coil or from outside coil to outside-air intake.
28. Verify operation of remote panel, including pilot-light operation and failure modes. Inspect the following:

- a. High-limit heat exchanger.
 - b. Warm-up for morning cycle.
 - c. Freezestat operation.
 - d. Economizer to limited outside-air changeover.
 - e. Alarms.
29. After startup and performance testing, change filters, vacuum heat exchanger and cooling and outside coils, lubricate bearings, adjust belt tension, and inspect operation of power vents.

3.05 ADJUSTING

- A. Adjust initial temperature and humidity set points.
- B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose, without additional cost.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain rooftop air conditioners.

END OF SECTION

SECTION 23 81 30

DUCTLESS SPLIT-SYSTEM AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Division 23 Section "Common Work Results"
- C. Division 23 Section "Refrigerant Piping".
- D. Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. This Section ductless mini-split systems.

1.03 ACTION SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: to include in emergency, operation, and maintenance manuals.

1.05 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of split-system units and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. A dry air holding charge shall be provided in the indoor section.
- D. The outdoor unit shall be pre-charged with refrigerant.

1.06 WARRANTY

- A. The units shall have a manufacturer's parts and defects warranty for a period five (5) years from date of installation. The compressor shall have an extended warranty of seven (7) years from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer. This warranty will not include labor.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Mitsubishi
 2. Daikin
 3. Fujitsu
 4. GE
 5. Samsung

2.02 DUCTLESS MINI SPLIT SYSTEMS

- A. Outdoor Units: The outdoor units shall be specifically designed to work with the manufacturer's family of indoor units. The outdoor unit shall be completely factory assembled, piped, and wired. Each unit shall be run tested at the factory prior to shipment.
1. Units need to provide year-round HVAC in a cold climate. Provide all available snow hoods (intakes and exhaust), wind baffles, base pan heaters, support stands, and other accessories.
 - a. Cooling only ductless splits: ambient cooling down to -40°F providing 100% capacity (only for PUY models with wind baffles installed).
 2. Provide hail guards.
 3. Unit Cabinet:
 - a. The casing shall be fabricated of galvanized steel, bonderized, finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection. Assembly hardware shall be cadmium plated for weather resistance.
 - b. Cabinet color shall be Munsell 3Y 7.8/1.1.
 - c. Two (2) mild steel mounting feet, traverse mounted across the cabinet base pan, welded mount, providing four (4) slotted mounting holes shall be furnished. Assembly shall withstand lateral wind gust up to 155 MPH to meet applicable weather codes.
 4. Fan:
 - a. The unit shall be furnished with a direct drive, high performance propeller type fan.
 - b. The condenser fan motor shall be a variable speed, direct current (DC) motor and shall have permanently lubricated bearings.

- c. Fan speed shall be switch automatically according to the number of operating indoor units and the compressor operating frequency.
 - d. The fan motor shall be mounted with vibration isolation for quiet operation.
 - e. The fan shall be provided with a raised guard to prevent contact with moving parts.
 - f. The outdoor unit shall have horizontal discharge airflow.
 - g. Outdoor unit sound level shall not exceed 55 dB (A).
- 5. Coil:
 - a. The outdoor unit coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.
 - b. The coil shall be protected with an integral guard.
 - c. Refrigerant flow from the outdoor unit to the indoor units shall be independently controlled by means of individual electronic linear expansion valves for each indoor unit.
 - d. Outdoor unit shall be pre-charged with sufficient R-410a refrigerant for up to one hundred and thirty-one (131) feet of refrigerant piping.
 - e. All refrigerant lines between outdoor and indoor units shall be of annealed, refrigeration grade copper tubing, ARC Type, meeting ASTM B280 requirements, individually insulated in twin-tube, flexible, closed-cell, CFC-free (ozone depletion potential of zero), elastomeric material for the insulation of refrigerant pipes and tubes with thermal conductivity equal to or better than 0.27 BTU-inch/hour per Sq Ft / °F, a water vapor transmission equal to or better than 0.08 Perm-inch and superior fire ratings such that insulation will not contribute significantly to fire and up to 1" thick insulation shall have a Flame-Spread Index of less than 25 and a Smoke-development Index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102.
 - f. All refrigerant connections between outdoor and indoor units shall be flare type.
- 6. Compressor:
 - a. The compressor shall be a high performance, hermetic, inverter driven, variable speed, dual rotary type.
 - b. The compressor motor shall be direct current (DC) type equipped with a factory supplied and installed inverter drive package.
 - c. The outdoor unit shall be equipped with a suction side refrigerant accumulator.
 - d. The compressor will be equipped with an internal thermal overload.
 - e. The compressor shall be mounted to avoid the transmission of vibration.
- B. Unit Controls:
 - 1. Factory-Installed Sensors:
 - a. Unit inlet air temperature.
 - b. Coil entering refrigerant temperature.
 - c. Coil leaving refrigerant temperature.
 - 2. Features and Functions:
 - a. Self-diagnostics.
 - b. Time delay.
 - c. Auto-restart.
 - d. Auto operation mode.
 - e. Manual operation mode.
 - f. Filter service notification.
 - g. Run test switch.

- C. Indoor Units: The indoor unit shall be fully factory assembled, wired, and run tested prior to shipment. Contained within the indoor unit shall be all factory wiring, piping, control circuit board, fan, and fan motor. The unit shall have a self-diagnostic function, 3-minute restart time delay mechanism, an auto restart function, an emergency / test operation. Indoor unit shall be charged with dry air before shipment from factory.
1. The indoor units shall be capable of working with single-zone or multi-zone outdoor units.
 2. Provide a drain pan level switch, designed to connect to the control board.
 3. Unit Cabinet:
 - a. The casing shall have a white finish– Munsell 1.0Y 9.2/0.2.
 - b. Multi directional drain and refrigerant piping, offering three (3) direction pipe alignment for all refrigerant piping and two (2) direction pipe alignment for condensate draining shall be standard.
 - c. Wall Mounted Units: There shall be a separate back plate that secures the indoor unit firmly to the wall. The installation-plate shall be securely attached to the wall using appropriate anchor method. Contractor shall determine the best method and be responsible for proper mounting of the installation plate to the wall.
 4. Fan - Wall Mounted:
 - a. The indoor unit fan shall be an assembly with a line-flow fan direct driven by a single motor.
 - b. The fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearing.
 - c. A manual adjustable guide vane shall be provided with the ability to change the airflow from side to side (left to right).
 - d. An integral, motorized, multi-position, horizontal air sweep flow louver shall provide for uniform air distribution, up and down. Five (5) positions plus Auto and Swing shall be provided, controlled from the remote controller.
 - e. The indoor fan shall operate at one of five (5) speeds: Super High, High, Medium, Low, and Quiet plus Auto Fan Mode for models up to 18,000 BTU/h, and four (4) speeds: Powerful, High, Medium and Low plus Auto Fan Mode for the 24,000 BTU/h model. All speeds shall be selected from the remote controller.
 5. Coil:
 - a. The indoor unit coil shall be of nonferrous construction with smooth plate fins on copper tubing.
 - b. The refrigerant tubing shall have inner grooves for high efficiency heat exchange.
 - c. All tube joints shall be brazed with PhosCopper or silver alloy.
 - d. The coils shall be pressure tested at the factory.
 - e. A sloped, corrosion resistant condensate pan with drain shall be provided under the coil.
 6. Electrical:
 - a. Enclosure: Metal, suitable for indoor locations.
 - b. Field Connection: Single point connection to power unit and integral controls.
 - c. Disconnecting Means: Factory-mounted circuit breaker or switch.
 - d. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
 - e. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
 - f. Raceways: Enclose line voltage wiring in raceways.

D. Interface to BAS: Mitsubishi PAC-UKPRC001-CN-1.

1. Provide for integration with the BAS, coordinate with Section 23 09 00.
2. BACnet MSTP (RS-485) with addressing 1-127
3. LED light notification status of valid communication between interface and BACnet network.
4. Approximate cable length is 37".
5. Commandable Points
 - a. Drive OFF/ON Setup
 - b. Setpoint
 - c. Mode Setup
 - d. Fan Speed Setup
 - e. Air Direction Setup
 - f. Temperature Units
6. Monitor Only Points
 - a. Drive OFF/ON State
 - b. Mode State
 - c. Fan Speed State
 - d. Air Direction State
 - e. Inlet Temperature
 - f. Fault Code
7. Wireless Handheld Control:
 - a. The unit shall have a wireless handheld controller to perform input functions necessary to operate the system.
 - b. The wireless handheld controller shall have a Power On/Off switch, Mode Selector – Cool, Dry, Heat, Auto Modes - Temperature Setting, Timer Control, Fan Speed Select and Auto Vane selector.
 - c. The indoor unit shall perform Self-diagnostic Function and Check Mode switching.
 - d. Temperature changes shall be by 1°F increments with a range of 61 - 88°F.
 - e. The microprocessor located in the indoor unit shall have the capability of sensing return air temperature and indoor coil temperature, receiving and processing commands from the wireless or a wired controller, providing emergency operation and controlling the outdoor unit.
 - f. The system shall be capable of automatically restarting and operating at the previously selected conditions when the power is restored after power interruption.
 - g. Control system shall control the continued operation of the air sweep louvers, as well as provide On/Off, System/Mode function.

2.03 OUTDOOR EQUIPMENT STANDS

- A. Quick-Sling MIRO, or equal; support stand. The bases shall be attached to the structure to prevent wind & seismic damage to the equipment.
1. Miami-Dade County Product Control Approved. NOA #21-0830.02; or 95 MPH wind rated.
 2. Hurricane-rated.
 3. All metal parts shall be either stainless steel or hot dip galvanized.
 4. Height: 24" minimum.

PART 3 - EXECUTION

3.01 EQUIPMENT INSTALLATION, GENERAL

A. Examination

1. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
2. Examine products before installation. Reject products that are wet, moisture damaged, or mold damaged.
3. Examine roughing-in for piping and tubing to verify actual locations of connections before equipment installation.
4. Examine roughing-in for ductwork to verify actual locations of connections before equipment installation.
5. Examine roughing-in for wiring and conduit to verify actual locations of connections before equipment installation.
6. Examine for suitable conditions where equipment will be installed. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Service Access:

1. Provide and document service access requirements.
2. Maintain manufacturer's recommended clearances for service and maintenance.
3. Maintain clearances required by governing code.
4. Locate equipment, system isolation valves, and other system components that require service and inspection in easily accessible locations. Avoid locations that are difficult to access if possible.
5. Where serviceable components are installed behind walls and above inaccessible ceilings, provide finished assembly with access doors or panels to gain access. Properly size the openings to allow for service, removal, and replacement.
6. If less than full and unrestricted access is provided, locate components within an 18-inch reach of the finished assembly.
7. Where ladder access is required to service elevated components, provide an installation that provides for sufficient access within ladder manufacturer's written instructions for use.
8. Comply with OSHA regulations.

3.02 INSTALLATION OF INDOOR UNITS

- A. Install units to be level and plumb while providing a neat and finished appearance.
- B. Unless otherwise required by VRF HVAC system manufacturer, support ceiling-mounted units from structure above using threaded rods; rod size per manufacturer instructions.
- C. Adjust supports of exposed and recessed units to draw units tight to adjoining surfaces.
- D. Protect finished surfaces of ceilings, floors, and walls that come in direct contact with units. Refinish or replaced damaged areas after units are installed.
- E. Provide lateral bracing if needed to limit movement of suspended units to not more than 0.25 inch.

- F. For floor- and wall-mounted units that are exposed, conceal piping and tubing, controls, and electrical power serving units within walls.
- G. Attachment: Install hardware for proper attachment to supported equipment.
- H. Grouting: Place grout under equipment supports and make bearing surface smooth.
- I. Provide condensate pump and condensate piping in accordance with the Maine plumbing code.

3.03 INSTALLATION OF OUTDOOR UNITS

- A. Install units to be level and plumb while providing a neat and finished appearance.
- B. Anchor units to supports with removable, cadmium-plated fasteners.
- C. Provide roof-mounting condensing unit support components bolted to roof sleepers that are securely fastened to the roof structure. Provide flashing in accordance with Division 7. Provide 24" high support stands.
- D. Provide roof piping penetrations as per Section 23 05 00

3.04 REFRIGERANT PIPING

- A. Provide per Section 23 23 00.
- B. Refrigerant: Provide as required by HVAC system manufacturer for system to comply with performance requirements indicated.
- C. Oil: Provide as required by HVAC system manufacturer and to comply with performance requirements indicated.
- D. Pre-insulated line sets may be used if approved by the heat pump manufacturer, provided the line sets meet all requirements set forth by the manufacturer and all joints are brazed.
- E. Provide piping adjacent to unit to allow service and maintenance.
- F. Coordinate locations of indoor units with structure, ceiling grid, and other trades – must maintain heat pump manufacturer's recommended service clearances.
- G. Provide roof piping penetrations as per Section 23 05 00.

3.05 CONDENSATE DRAINS

- A. Provide condensate trap and drain piping per unit manufacturer's instructions. Provide per Section 22 13 16.
- B. Provide condensate pump. See specification section 22 13 16 "Plumbing Sanitary & Storm Piping".
- C. Provide a drain pan level switch, installed on the condensate pan to prevent condensate from overflowing. Provide integration with the BAS as specified in Section 23 09 00 "Instrumentation & Control".

3.06 ELECTRICAL

- A. Electrical: Comply with requirements indicated on Drawings and in applicable Division 26 Sections.
- B. Provide a programmable 3-phase line voltage monitor for each outdoor unit, see 230500.
- C. For data communication wiring, comply with TIA-607-B and with BICSI TDM, "Bonding and Grounding (Earthing)" Chapter.
- D. Electrical Connections: Comply with requirements in Electrical Specification Sections for power wiring, switches, and motor controls.

3.07 INSTALLATION OF SYSTEM CONTROL CABLE

- A. Comply with NECA 1.
- B. Low-Voltage Control Cabling: Provide per Division 26, NFPA 70, and equipment manufacturer's instructions.
- C. General Requirements for Cabling:
 - 1. Comply with TIA-568-C Series of standards.
 - 2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems."
 - 3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
 - 4. Cables may not be spliced and shall be continuous from terminal to terminal. Do not splice cable.
 - 5. Cables serving a common system may be grouped in a common raceway. Install control cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
 - 6. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.
 - 8. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
 - 9. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Do not use heat lamps for heating.
 - 10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Monitor cable pull tensions.
 - 11. Support: Do not allow cables to lie on removable ceiling tiles or access panels.
 - 12. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
 - 13. Provide strain relief.
 - 14. Keep runs short. Allow extra length for connecting to terminals.
 - 15. Do not bend cables in a radius less than 10 times the cable OD.
 - 16. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
 - 17. Ground wire shall be copper, and grounding methods shall comply with IEEE C2. Demonstrate ground resistance.

- D. Balanced Twisted-Pair Cable Installation: Comply with TIA-568-C.2. Do not untwist balanced twisted-pair cables more than 1/2 inch at the point of termination to maintain cable geometry.
- E. Open-Cable Installation: Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 30 inches apart. Cable shall not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.
- F. Separation from EMI Sources: Comply with BICSI TDMM and TIA-569-D recommendations for separating unshielded cable from potential EMI sources including electrical power wiring and equipment.

3.08 FIELD QUALITY CONTROL

- A. Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.
- B. Engage a factory-authorized service representative to perform startup service. Complete installation and startup checks according to manufacturer's written instructions.
- C. Perform the following field tests and inspections and prepare test reports:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Check control communications of equipment and each operating component in system(s).
 - 3. Check each indoor unit's response to demand for cooling and heating.
 - 4. Check each indoor unit's response to changes in airflow settings.
 - 5. Check each indoor unit, HRCU, and outdoor unit for proper condensate removal.
 - 6. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 7. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Remove and replace malfunctioning units and retest as specified above.

3.09 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.
- B. Refer to Division 1 for further requirements.

END OF SECTION

SECTION 26 01 00

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. Section Includes:
 - 1. General requirements applicable to all Division 26 sections.
 - 2. Allowances for Utility Construction Charges

1.03 TEMPORARY POWER AND LIGHTING

- A. Provide a separately metered temporary electrical service for the construction area.
- B. Provide temporary utility services to existing facilities as required to maintain operation of those facilities during construction. Coordinate with Owner and Utilities.
- C. Power Distribution: Provide weatherproof, grounded circuits with ground-fault interruption features, with proper power characteristics and either permanently wired or plug-in connections as appropriate for intended use. Provide overload-protected disconnect switch for each circuit at distribution panel. Space 4-gang convenience outlets (20 amp circuit) so that every portion of work can be reached with 100' extension cord.
- D. Temporary Lighting: Provide lighting of intensity and quality sufficient for proper and safe performance of the work and for access thereto and security thereof, minimum average illumination level in every room shall be 20 footcandles.

1.04 ALLOWANCES FOR UTILITY CONSTRUCTION CHARGES

- A. Provide a \$50,000 allowance as specified in Division 01 for utility company construction charges associated with the electric, phone, and CATV services.

1.05 GENERAL REQUIREMENTS APPLICABLE TO ALL DIVISION 26 SECTIONS

A. Regulatory Requirements:

1. Conform to the requirements of all laws and regulations applicable to the work.
2. Conform to the requirements of Federal State and Municipal Building Codes.
3. Cooperate with all authorities having jurisdiction.
4. Compliance with laws and regulations governing the work on this project does not relieve the Contractor from compliance with more restrictive requirements contained in these specifications.
5. If the Contract Documents are found to be at variance with any law or regulation, the Contractor shall notify the Architect/Engineer promptly in writing. The Contractor shall assume full responsibility for any work contrary to law or regulation, and shall bear all costs for the corrections thereof.
6. Minimum Requirements: The more stringent of the 2011 National Electrical Code (NEC) or the edition enforced by the local Authority Having Jurisdiction, Underwriters Laboratories, Inc. (UL), the National Fire Codes, and National Fire Protection Association (NFPA) are a minimum requirement for work under this section. Design drawings and other specification sections shall govern in those instances where requirements are greater than those required by code.

B. REFERENCES

1. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
 - a. National Fire Protection Association (NFPA).
 - b. National Electrical Code (NEC)
 - c. National Electrical Safety Code (NESC)
 - d. Underwriters Laboratories, Inc. (UL)
 - e. American National Standards Institute (ANSI)
 - f. Certified Ballast Manufacturers Association (CBM)
 - g. National Electrical Manufacturers Association (NEMA)
 - h. International Municipal Signal Association (IMSA)
 - i. Institute of Electrical and Electronic Engineers (IEEE)
 - j. American Society for Testing Materials Specifications (ASTM)
 - k. National Bureau of Standards Handbook (NBS)
 - l. Occupational Safety and Health Administration (OSHA)
 - m. Americans with Disabilities Act (ADA)
 - n. Insulated Power Cable Engineers Association Specifications (IPCEA)

C. Permits, Fees, and Inspections:

1. Secure and pay for all permits, fees, licenses, inspections, etc., required for the work under Division 26.
2. Schedule and pay for all legally required inspections and cooperate with inspecting officers.
3. Provide Certificates of Inspection and Approval from all regulatory authorities having jurisdiction over the work in Division 26.

D. The Contractor shall study all drawings and specifications and acquaint itself with the existing conditions and the requirements of the plans and specifications. No claim will be recognized for extra compensation due to the failure of the Contractor to familiarize itself with the conditions and extent of the proposed work.

- E. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- F. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

1.06 EFFICIENCY MAINE

- A. This project intends to pursue Efficient Maine prescriptive and/or custom incentives. The contractor shall be an Efficiency Maine Qualified Partner and shall participate in the activities associated with Efficiency Maine incentive pre-approval and approval process including but not limited to; preparation and submission of required incentive application(s) and the tracking and submission of measure specific invoices to Efficiency Maine within 60 days of the completion of the work.
- B. The contractor shall also:
 - 1. Become familiar with the Efficiency Maine Business Program including available incentives and the application and review process.
 - 2. Review plans and specifications for any and all incentive opportunities, prescriptive and custom.
- C. The project schedule shall reflect and accommodate the time required to achieve application preapproval from Efficiency Maine. No equipment shall be purchased until preapproval is received from Efficiency Maine.
- D. All invoices shall be forwarded to Efficiency Maine in accordance with Efficiency Maine requirements. This deliverable shall be shown on the project schedule as a milestone date and coordinated with all contractors to assure compliance with this requirement.

1.07 BACKBOARDS

- A. Backboards: Provide backboards in each electrical and IT room. Backboards shall line all walls of the room. Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels specified in Division 06 Section "Rough Carpentry."

1.08 COORDINATION

- A. Provide coordination drawings in accordance with Division 01.
- B. Coordinate the work of Division 26 with other Divisions, the Owner, and utility companies.
- C. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.

- 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- D. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- E. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08.
- F. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07.

PART 2 - PRODUCTS – Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION

SECTION 26 05 13

MEDIUM-VOLTAGE CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. Section Includes:
 - 1. Cables.
 - 2. Connectors.
 - 3. Solid terminations.
 - 4. Separable insulated connectors.
 - 5. Splice kits.
 - 6. Medium-voltage tapes.
 - 7. Arc-proofing materials.
 - 8. Fault indicators.
- B. Related Requirements:
 - 1. Appendix: DOC Standard Terms and Conditions (BABAA)

1.03 DEFINITIONS

- A. Jacket: A continuous nonmetallic outer covering for conductors or cables.
- B. NETA ATS: Acceptance Testing Specification.
- C. Sheath: A continuous metallic covering for conductors or cables.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of cable. Include splices and terminations for cables and cable accessories.
- B. Samples: 16-inch lengths for each type of cable specified.
- C. Sustainable Design Submittals:
 - 1. Product Data: For each conductor and cable indicating lead content.

2. Product Data: For solvents and adhesives, indicating VOC content.
3. Laboratory Test Reports: For solvents and adhesives, indicating compliance with requirements for low-emitting materials.

1.05 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Indicate location of each cable, splice, and termination.
- B. Qualification Data: For Installer and testing agency.
- C. Material Certificates: For each type of cable and accessory.
- D. Design Data: Cable pulling calculations, including conduit size and fill percentage, pulling tensions, cable sidewall pressure, jam probability, voltage drop, and ground wire sizing for each cable.
- E. Source quality-control reports.
- F. Field quality-control reports.

1.06 QUALITY ASSURANCE

- A. Installer: Engage a cable splicer, trained and certified by splice material manufacturer with minimum 10 years of experience, to install, splice, and terminate medium-voltage cable.
- B. Testing Agency Qualifications: Member company of NETA or an NRTL.
 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.07 FIELD CONDITIONS

- A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 1. Notify Construction Manager, Engineer, and Owner no fewer than four weeks in advance of proposed interruption of electric service.
 2. Do not proceed with interruption of electric service without Construction Manager's, Engineer's, and Owner's written permission.
 3. Arrange to have all power interruption occur on third shift or weekends.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION and REQUIRMENTS

- 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 IEEE C2 and NFPA 70.
- C. Source Limitations: Obtain cables and accessories from single source from single manufacturer.

- D. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant

2.02 CABLES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Kerite Co. (The).
 - 2. Okonite Company (The).
- B. Cable Type: Type MV 105.
- C. Conductor Insulation: Ethylene-propylene rubber.
 - 1. Voltage Rating: 15 kV.
 - 2. Insulation Thickness: 133 percent insulation level.
- D. Conductor: Copper.
- E. Comply with UL 1072, AEIC CS8, ICEA S-93-639/NEMA WC 74.
- F. Conductor Stranding: Compact round, concentric lay, Class B.
- G. Lead Content: Less than 300 parts per million.
- H. Shielding: Copper tape, helically applied over semiconducting insulation shield.
- I. Cable Jacket: Sunlight-resistant PVC.

2.03 CONNECTORS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. 3M.
 - 2. Thomas & Betts by ABB, Electrification Products Division.
 - 3. Eaton.
 - 4. nVent (RAYCHEM).
- B. Comply with ANSI C119.4 for connectors between aluminum conductors or for connections between aluminum to copper conductors.
- C. Copper-Conductor Connectors: Copper shear bolt connectors.

2.04 SOLID TERMINATIONS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. 3M.
 2. Thomas & Betts by ABB, Electrification Products Division.
 3. Eaton.
 4. nVent (RAYCHEM).
- B. Shielded-Cable Terminations: Comply with the following classes of IEEE 48. Insulation class shall be equivalent to that of cable. Include shield ground strap for shielded cable terminations.
1. Class 1 Terminations:
 - a. Modular type, furnished as a kit, with stress-relief tube; multiple, molded-silicone-rubber, insulator modules; shield ground strap; and compression-type connector.

2.05 SEPARABLE INSULATED CONNECTORS

- A. Description: Modular system, complying with IEEE 386, with disconnecting, single-pole, cable terminators and with matching, stationary, plug-in, dead-front terminals designed for cable voltage and for sealing against moisture.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. 3M.
 2. Thomas & Betts by ABB, Electrification Products Division.
 3. Eaton.
 4. nVent (RAYCHEM).
- C. Terminations at Distribution Points: Modular type, consisting of terminators installed on cables and modular, dead-front, terminal junctions for interconnecting cables.
- D. Load-Break Cable Terminators: Elbow-type units with 200 A load make/break and continuous-current rating; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.
- E. Dead-Break Cable Terminators: Elbow-type unit with 600 A continuous-current rating; designed for de-energized disconnecting and connecting; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.
- F. Dead-Front Terminal Junctions: Modular bracket-mounted groups of dead-front stationary terminals that mate and match with above cable terminators. Two-, three-, or four-terminal units as indicated, with fully rated, insulated, watertight conductor connection between terminals and complete with grounding lug, manufacturer's standard accessory stands, stainless steel mounting brackets, and attaching hardware.
1. Protective Cap: Insulating, electrostatic-shielding, water-sealing cap with drain wire.
 2. Portable Feed-Through Accessory: Two-terminal, dead-front junction arranged for removable mounting on accessory stand of stationary terminal junction.
 3. Grounding Kit: Jumpered elbows, portable feed-through accessory units, protective caps, test rods suitable for concurrently grounding three phases of feeders and carrying case.
 4. Standoff Insulator: Portable, single dead-front terminal for removable mounting on accessory stand of stationary terminal junction. Insulators suitable for fully insulated isolation of energized cable-elbow terminator.

- G. Test-Point Fault Indicators: Applicable current-trip ratings and arranged for installation in test points of load-break separable connectors, and complete with self-resetting indicators capable of being installed with shotgun hot stick and tested with test tool.
- H. Tool Set: Shotgun hot stick with energized terminal indicator, fault-indicator test tool, and carrying case.

2.06 SPLICE KITS

- A. Description: For connecting medium voltage cables; type as recommended by cable or splicing kit manufacturer for the application.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. 3M.
 - 2. Thomas & Betts by ABB, Electrification Products Division.
 - 3. Eaton.
 - 4. nVent (RAYCHEM).
- C. Standard: Comply with IEEE 404.
- D. Splicing Products: As recommended, in writing, by splicing kit manufacturer for specific sizes, materials, ratings, and configurations of cable conductors. Include all components required for complete splice, with detailed instructions.
 - 1. Heat-shrink splicing kit of uniform, cross-section, polymeric construction with outer heat-shrink jacket.
 - 2. Premolded, cold-shrink-rubber, in-line splicing kit.
 - 3. Premolded, EPDM splicing body kit with cable joint sealed by interference fit of mating parts and cable.
 - 4. Separable multiway splice system with all components for the required splice configuration.

2.07 MEDIUM-VOLTAGE TAPES

- A. Description: Electrical grade, insulating tape rated for medium voltage application.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. 3M.
 - 2. Thomas & Betts by ABB, Electrification Products Division.
 - 3. Eaton.
 - 4. nVent (RAYCHEM).
- C. Ethylene/propylene rubber-based, 30 mil splicing tape, rated for 130 deg. C operation. Minimum 3/4 inch wide.
- D. Silicone rubber-based, 12 mil self-fusing tape, rated for 130 deg. C operation. Minimum 1-1/2 inch wide.
- E. Insulating-putty, 125 mil elastic filler tape. Minimum 1-1/2 inch wide.

2.08 ARC-PROOFING MATERIALS

- A. Description: Fire retardant, providing arc flash protection.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. 3M.
 - 2. Thomas & Betts by ABB, Electrification Products Division.
 - 3. Eaton.
 - 4. nVent (RAYCHEM).
- C. Tape for First Course on Metal Objects: 10 mil thick, corrosion-protective, moisture-resistant, PVC pipe-wrapping tape.
- D. Arc-Proofing Tape: Fireproof tape, flexible, conformable, intumescent to 0.3 inch thick, and compatible with cable jacket.
- E. Glass-Cloth Tape: Pressure-sensitive adhesive type, 1 inch wide.

2.09 FAULT INDICATORS

- A. Indicators: Manually reset fault indicator, arranged to clamp to cable sheath and provide a display after a fault has occurred in cable. Instrument shall not be affected by heat, moisture, and corrosive conditions and shall be recommended by manufacturer for installation conditions.
- B. Resetting Tool: Designed for use with fault indicators, with moisture-resistant storage and carrying case.

2.10 SOURCE QUALITY CONTROL

- A. Test and inspect cables according to ICEA S-97-682 before shipping.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install cables according to IEEE 576.
- B. Proof conduits prior to conductor installation by passing a wire brush mandrel and then a rubber duct swab through the conduit. Separate the wire brush and the rubber swab by 48 to 72 inch on the pull rope.
 - 1. Wire Brush Mandrel: Consists of a length of brush approximately the size of the conduit inner diameter with stiff steel bristles and an eye on each end for attaching the pull ropes. If an obstruction is felt, pull the brush back and forth repeatedly to break up the obstruction.
 - 2. Rubber Duct Swab: Consists of a series of rubber discs approximately the size of the conduit inner diameter on a length of steel cable with an eye on each end for attaching the pull ropes. Pull the rubber duct swab through the duct to extract loose debris from the duct.

- C. Pull Conductors: Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
 - 1. Where necessary, use manufacturer-approved pulling compound or lubricant that does not deteriorate conductor or insulation.
 - 2. Use pulling means, including fish tape, cable, rope, and basket-weave cable grips, that do not damage cables and raceways. Do not use rope hitches for pulling attachment to cable.
 - 3. Use pull-in guides, cable feeders, and draw-in protectors as required to protect cables during installation.
 - 4. Do not pull cables with ends unsealed. Seal cable ends with rubber tape.
- D. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."
- E. In manholes, handholes, pull boxes, junction boxes, and cable vaults, train cables around walls by the longest route from entry to exit; support cables at intervals adequate to prevent sag.
- F. Install sufficient cable length to remove cable ends under pulling grips. Remove length of conductor damaged during pulling.
- G. Install cable splices at pull points and elsewhere as indicated; use standard kits. Use dead-front separable watertight connectors in manholes and other locations subject to water infiltration.
- H. Install terminations at ends of conductors.
- I. Install separable insulated-connector components as follows:
 - 1. Protective Cap: At each terminal junction, with one on each terminal to which no feeder is indicated to be connected.
 - 2. Portable Feed-Through Accessory: At each terminal junction, with one on each terminal.
 - 3. Standoff Insulator: At each terminal junction, with one on each terminal.
- J. Arc Proofing: Unless otherwise indicated, arc proof medium-voltage cable at locations not protected by conduit or termination materials. In addition to arc-proofing tape manufacturer's written instructions, apply arc proofing as follows:
 - 1. Clean cable sheath.
 - 2. Wrap metallic cable components with 10 mil pipe-wrapping tape.
 - 3. Smooth surface contours with electrical insulation putty.
 - 4. Apply arc-proofing tape in one half-lapped layer with coated side toward cable.
 - 5. Band arc-proofing tape with two layers of 1 inch wide half-lapped, adhesive, glass-cloth tape at each end of the arc-proof tape.
- K. Seal around cables passing through fire-rated elements according to Section 07 84 13 "Penetration Firestopping."
- L. Install fault indicators on each phase.
- M. Ground shields of shielded cable at terminations, splices, and separable insulated connectors. Ground metal bodies of terminators, splices, cable and separable insulated-connector fittings, and hardware.
- N. Identify cables according to Section 26 05 53 "Identification for Electrical Systems." Identify phase and circuit number of each conductor at each splice, termination, pull point, and junction

box. Arrange identification so that it is unnecessary to move the cable or conductor to read the identification.

3.02 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
 - 2. After installing medium-voltage cables and before electrical circuitry has been energized, test for compliance with requirements.
 - 3. Perform direct-current High Potential test of each new conductor according to NETA ATS, Ch. 7.3.3. Do not exceed cable manufacturer's recommended maximum test voltage.
 - 4. Perform Partial Discharge test of each new conductor according to NETA ATS, Ch. 7.3.3 and to test equipment manufacturer's recommendations.
 - 5. Perform Dissipation Factor test of each new conductor according to NETA ATS, Ch. 7.3.3 and to test equipment manufacturer's recommendations.
- C. Medium-voltage cables will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. Section Includes:
 - 1. Copper building wire rated 600 V or less.
 - 2. Aluminum building wire rated 600 V or less.
 - 3. Metal-clad cable, Type MC, rated 600 V or less.
 - 4. Connectors, splices, and terminations rated 600 V and less.
- B. Related Requirements:
 - 1. Section 26 05 23 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.
 - 2. Section 27 13 13 "Communications Copper Backbone Cabling" for twisted pair cabling used for data circuits.
 - 3. Section 27 15 13 "Communications Copper Horizontal Cabling" for twisted pair cabling used for data circuits.

1.03 DEFINITIONS

- A. RoHS: Restriction of Hazardous Substances.
- B. VFC: Variable-frequency controller.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: Indicate type, use, location, and termination locations.

1.05 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

- 2.01 ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant

2.02 COPPER BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. 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. [Alpha Wire Company.](#)
 2. [Belden Inc.](#)
 3. [General Cable Technologies Corporation.](#)
 4. [Southwire Company.](#)
- C. Standards:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 2. RoHS compliant.
 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- E. Conductor Insulation:
1. Type THHN and Type THWN-2: Comply with UL 83.
- F. Shield:
1. Type TC-ER: Cable designed for use with VFCs, with oversized crosslinked polyethylene insulation, spiral-wrapped foil plus 85 percent coverage braided shields and insulated full-size ground wire, and sunlight- and oil-resistant outer PVC jacket.

2.03 ALUMINUM BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn aluminum current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. 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. [Alpha Wire Company.](#)
 2. [Cerro Wire LLC.](#)
 3. [General Cable Technologies Corporation.](#)

4. Okonite Company (The).
5. Southwire Company.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Aluminum, complying with ASTM B 800 and ASTM B 801.

E. Conductor Insulation:

1. Type THHN and Type THWN-2: Comply with UL 83.
2. Type XHHW-2: Comply with UL 44.

2.04 METAL-CLAD CABLE, TYPE MC

A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Alpha Wire Company.
2. General Cable Technologies Corporation.
3. Southwire Company.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569.
3. RoHS compliant.
4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits:

1. Single circuit and multicircuit with color-coded conductors.
2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.

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: Steel or Aluminum, interlocked.

2.05 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. 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. 3M Electrical Products.
 - 2. Ideal Industries, Inc.
 - 3. ILSCO.
- C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

PART 3 - EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Conductors shall be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- C. VFC Output Circuits Cable: Extra-flexible stranded for all sizes.
- D. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN/THWN-2, single conductors in concrete encased underground raceway.
- B. Exposed Feeders: Exposed Feeders: Type MI cable where 2-hour rated feeders are indicated and Type THHN-2-THWN-2, single conductors in raceway for other feeders.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type MI cable where 2-hour rated feeders are indicated and Type THHN-2-THWN-2, single conductors in raceway for other feeders.

- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in concrete encased raceway.
- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Metal-clad cable, Type MC.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway. Underground raceways for the emergency system shall be concrete encased
- H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application. Provide coil cord where indicated on the drawings.
- I. VFC Output Circuits: Type XHHW-2 in metal conduit or Type TC-ER cable with braided shield.

3.03 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 26 05 33 "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 26 05 29 "Hangers and Supports for Electrical Systems."

3.04 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 and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.05 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 26 05 53 "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.

3.06 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.07 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07.

3.08 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and emergency system feeder conductors and conductors for compliance with requirements.
 - 2. Perform each of the following visual and electrical tests:
 - a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
 - b. Test bolted connections for high resistance using one of the following:
 - 1) A low-resistance ohmmeter.
 - 2) Calibrated torque wrench.
 - 3) Thermographic survey.
 - c. Inspect compression-applied connectors for correct cable match and indentation.
 - d. Inspect for correct identification.
 - e. Inspect cable jacket and condition.
 - f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
 - g. Continuity test on each conductor and cable.
 - h. Uniform resistance of parallel conductors.
 - 3. Initial Infrared Scanning: After Substantial Completion, but before Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

- a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - b. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- B. Cables will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports to record the following:
 - 1. Procedures used.
 - 2. Results that comply with requirements.
 - 3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. Section includes grounding and bonding systems and equipment.
- B. Section includes grounding and bonding systems and equipment, plus the following special applications:
 - 1. Foundation steel electrodes.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.04 INFORMATIONAL SUBMITTALS

- A. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Test wells.
 - 2. Ground rods.
 - 3. Grounding arrangements and connections for separately derived systems.
- B. Qualification Data: For testing agency and testing agency's field supervisor.
- C. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.01 ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant.

2.02 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. Burndy; Part of Hubbell Electrical Systems.
 2. ERICO International Corporation.
 3. ILSCO.
 4. O-Z/Gedney; a brand of Emerson Industrial Automation.
 5. Thomas & Betts Corporation; A Member of the ABB Group.
- B. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant.

2.03 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.04 CONDUCTORS

- A. Insulated Conductors: Copper or tinned-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 (6 mm)** 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 (41 mm)** wide and **1/16 inch (1.6 mm)** thick.
 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; **1-5/8 inches (41 mm)** wide and **1/16 inch (1.6 mm)** thick.

- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.05 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- F. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.
- G. Conduit Hubs: Mechanical type, terminal with threaded hub.
- H. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- I. Lay-in Lug Connector: Mechanical type, aluminum terminal with set screw.
- J. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.
- K. Water Pipe Clamps:
 - 1. Mechanical type, two pieces with zinc-plated bolts.
 - a. Material: Die-cast zinc alloy.
 - b. Listed for direct burial.
 - 2. U-bolt type with malleable-iron clamp and copper ground connector rated for direct burial.

2.06 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m).

PART 3 - EXECUTION

3.01 APPLICATIONS

- A. Conductors: Install solid conductor for No. 10 AWG and smaller, and stranded conductors for No. 8 AWG and larger unless otherwise indicated.

- B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 24 inches (600 mm) below grade.
 - 2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.
- C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
- D. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.02 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.03 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with utility company requirements.
- B. Comply with IEEE C2 grounding requirements.
- C. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.
- D. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.
- E. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.

3.04 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. 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.
- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.05 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 26 05 43 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.
 - 1. Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

H. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 20 feet (6.0 m) long. If reinforcing is in multiple pieces, connect together by the usual steel tie wires or exothermic welding to create the required length.

3.06 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at ground test wells..
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

- E. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 10 ohms.
- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

1.03 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.04 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.05 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel slotted support systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze hangers. Include Product Data for components.
 - 2. Steel slotted channel systems. Include Product Data for components.
 - 3. Equipment supports.

1.06 QUALITY ASSURANCE

- A. Comply with NFPA 70.

1.07 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.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07.

PART 2 - PRODUCTS

2.01 ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant

2.02 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. [Cooper B-Line, Inc.; a division of Cooper Industries.](#)
 - b. [ERICO International Corporation.](#)
 - c. [Thomas & Betts Corporation.](#)
 - d. [Unistrut; Tyco International, Ltd.](#)
 - 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 and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless 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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) [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.](#)
 - 2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 5. Toggle Bolts: All-steel springhead type.
 - 6. Hanger Rods: Threaded steel.

2.03 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 Division 05 for steel shapes and plates.

PART 3 - EXECUTION

3.01 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 scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be **1/4 inch (6 mm)** in diameter.

- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with two-bolt conduit clamps or single-bolt conduit clamps using spring friction action for retention in support channel.

3.02 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 (90 kg).
- 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: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 - 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.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.03 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.

3.04 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete.

- C. Anchor equipment to concrete base.
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.05 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of **2.0 mils** (0.05 mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
 - 1. Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.03 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. FMC: Flexible metal conduit.
- D. IMC: Intermediate metal conduit.
- E. LFMC: Liquidtight flexible metal conduit.
- F. NBR: Acrylonitrile-butadiene rubber.
- G. RNC: Rigid nonmetallic conduit.

1.04 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Custom enclosures and cabinets.
 - 2. For handholes and boxes for underground wiring, including the following:

- a. Duct entry provisions, including locations and duct sizes.
 - b. Frame and cover design.
 - c. Grounding details.
 - d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
 - e. Joint details.
- C. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will retain its enclosure characteristics, including its interior accessibility, after the seismic event."

1.05 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant

2.02 METAL CONDUIT AND TUBING

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Alflex Inc.
 - 3. Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 4. O-Z Gedney; a unit of General Signal.
 - 5. Wheatland Tube Company.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. IMC: ANSI C80.6.
- D. EMT: ANSI C80.3.

- E. FMC: Zinc-coated steel.
- F. LFMC: Flexible steel conduit with PVC jacket.
- G. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
 - 2. Fittings for EMT: Steel set-screw type.
 - 3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
- H. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.03 NONMETALLIC CONDUIT AND TUBING

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - 3. Arnco Corporation.
 - 4. CANTEX Inc.
 - 5. Carlon Electrical Products.
 - 6. RACO; a Hubbell Company.
 - 7. Thomas & Betts Corporation.
- B. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.
- C. Fittings and RNC: NEMA TC 3; match to conduit or tubing type and material.

2.04 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Arnco Corporation.
 - 2. Endot Industries Inc.
 - 3. IPEX Inc.
 - 4. Lamson & Sessions; Carlon Electrical Products.
- C. Description: Comply with UL 2024; flexible type, approved for plenum installation.

2.05 METAL WIREWAYS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cooper B-Line, Inc.
 - 2. Hoffman.
 - 3. Square D; Schneider Electric.
- B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Hinged type.
- E. Finish: Manufacturer's standard enamel finish.

2.06 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 - 2. EGS/Appleton Electric.
 - 3. Erickson Electrical Equipment Company.
 - 4. Hoffman.
 - 5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
 - 6. O-Z/Gedney; a unit of General Signal.
 - 7. RACO; a Hubbell Company.
 - 8. Thomas & Betts Corporation.
 - 9. Walker Systems, Inc.; Wiremold Company (The).
- B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- D. Metal Floor Boxes: Cast metal, rectangular. Basis of Design is FSR, Inc. FL-500P series.
 - 1. Provide with pour pan for grade-level application where required.
 - 2. Provide with cover and trim as applicable to finished flooring.
 - 3. Trim and cover color as selected by Architect from manufacturers standard.
 - 4. Provide complete with all components required to create configurations indicated or scheduled on the drawings. Where empty floor boxes are indicated, provide blank internal device plates.
- E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- F. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic finished inside with radio-frequency-resistant paint.

H. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.07 SLEEVES FOR RACEWAYS

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

PART 3 - EXECUTION

3.01 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
 1. Exposed Conduit: Rigid steel conduit.
 2. Concealed Conduit, Aboveground: Rigid steel conduit.
 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC
 4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R
- B. Comply with the following indoor applications, unless otherwise indicated:
 1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
 - a. Apparatus bays.
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 6. Damp or Wet Locations: Rigid steel conduit

7. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: EMT.
 8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, in damp or wet locations.
- C. Minimum Raceway Size: $\frac{3}{4}$ 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.
- E. Do not install aluminum conduits in contact with concrete.

3.02 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least **6 inches (150 mm)** away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- H. Raceways Embedded in Slabs:
1. Run conduit larger than **1-inch (27-mm)** trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 3. Change from RNC to rigid steel conduit, or IMC before rising above the floor.
- I. 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.
- J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than **200-lb (90-kg)** tensile strength. Leave at least **12 inches (300 mm)** of slack at each end of pull wire.

- L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:
1. **3/4-Inch (19-mm)** Trade Size and Smaller: Install raceways in maximum lengths of **50 feet (15 m)**.
 2. **1-Inch (25-mm)** Trade Size and Larger: Install raceways in maximum lengths of **75 feet (23 m)**.
 3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where otherwise required by NFPA 70.
- N. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed **30 deg F (17 deg C)**, and that has straight-run length that exceeds **25 feet (7.6 m)**.
1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: **125 deg F (70 deg C)** temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: **155 deg F (86 deg C)** temperature change.
 - c. Indoor Spaces: Connected with the Outdoors without Physical Separation: **125 deg F (70 deg C)** temperature change.
 2. Install fitting(s) that provide expansion and contraction for at least **0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C)** of temperature change.
 3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
- O. 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.
- P. Set metal floor boxes level and flush with finished floor surface.

3.03 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
 - 1. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - 2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both surfaces of walls.
- G. Extend sleeves installed in floors 6 inches (50 mm) above finished floor level unless noted otherwise.
- H. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway unless sleeve seal is to be installed.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."
- L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.
- M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.04 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground, exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.05 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.06 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 05 43

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Type EPEC raceways and fittings.
2. Type ERMCS raceways, elbows, couplings, and nipples.
3. Type ERMCS raceways, elbows, couplings, and nipples.
4. Type IMC raceways.
5. Type PVC raceways and fittings.
6. Type RTRC-BG raceways and fittings.
7. Fittings for conduit, tubing, and cable.
8. Electrically conductive corrosion-resistant compounds for threaded conduit.
9. Solvent cements.
10. Duct accessories.
11. Handholes and boxes for exterior underground wiring.
12. Manholes for exterior underground wiring.
13. Utility structure accessories.
14. Duct sealing.

B. Related Requirements:

1. Section 26 00 10 "Supplemental Requirements for Electrical" specifies additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 26 00 11 "Facility Performance Requirements for Electrical" specifies seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.
3. **Section 01 31 00 "Project Management and Coordination"** specifies preinstallation conference procedures.
4. Section 26 05 19 "Low-Voltage for Electrical Power Conductors and Cables" specifies nonmetallic underground conduit with conductors (Type NUCC).
5. Section 26 05 53 "Identification for Electrical Systems" specifies underground-line warning tape and concrete cable routing markers (warning planks).

C. Related Sections include the following:

1. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 ALLOWANCES

- A. See Section 01 21 00 "Allowances" for description of allowances affecting items specified in this Section.

1.03 UNIT PRICES

- A. See Section 01 22 00 "Unit Prices" for description of unit prices affecting items specified in this Section.

1.04 ALTERNATES

- A. See Section 01 23 00 "Alternates" for description of alternates affecting items specified in this Section.

1.05 DEFINITIONS

- A. Duct: A single raceway or multiple raceways, installed singly or as components of a duct bank.
- B. Duct Bank: Two or more ducts installed in parallel, direct buried or with additional casing materials such as concrete.
- C. Handhole: An underground chamber containing electrical cables, sized such that personnel are not required to enter in order to access the cables.
- D. Manhole: An underground chamber containing electrical cables and equipment, sized to provide access with working space clearances.
- E. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

1.06 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **Project site**.
- B. Preinstallation Coordination Meeting(s): For underground ducts and raceways. Conduct meeting(s) **as videoconference or at Project site** before start of construction.
 - 1. Attendees: Installers, fabricators, representatives of manufacturers, and administrators for field tests and inspections. Notify Architect, **Construction Manager, and Owner's Commissioning Authority** of scheduled meeting dates.

1.07 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For concrete and steel used in precast concrete **manholes and handholes**, also include product certificates as required by ASTM C858.
- B. Shop Drawings:
 - 1. Electric Utility Duct Banks and Structures:
 - a. Include plans, elevations, sections, and details, including attachments to other Work.
 - b. Indicate locations of private property boundaries and utility easements.
 - c. Include information required for approval by electric utility and for obtaining public space utility work permits.
 - 2. Precast or Factory-Fabricated Concrete Structures:
 - a. Include plans, elevations, sections, and details, including attachments to other Work.

- b. Include duct entry provisions, including locations and duct sizes, and methods and materials for waterproofing duct entry locations.
 - c. Include reinforcement details.
 - d. Include frame and cover design and manhole chimneys.
 - e. Include **ladder** or **step** details.
 - f. Include grounding details.
 - g. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, sumps, and other accessories.
 - h. Include joint details.
- 3. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:
 - a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
 - b. Include duct entry provisions, including locations and duct sizes, and methods and materials for waterproofing duct entry locations.
 - c. Include cover design.
 - d. Include grounding details.
 - e. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, and other accessories.
- C. Field quality-control reports.

1.08 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.
- B. Field Reports:
 - 1. Factory Test Reports: For handholes and boxes.
 - 2. Manufacturer's field reports for field quality-control support.

1.09 MAINTENANCE MATERIAL SUBMITTALS

- A. Spare Parts: Furnish to Owner spare parts necessary for repairing or adding more cables to manholes or handholes that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Cable-Support Stanchions, Arms, and Associated Fasteners: **Five** percent of quantity of each item installed.
 - 2. Insulators: **Five** percent of quantity of each item installed.

1.10 REGULATORY AGENCY APPROVALS

- A. Shop Drawing submittals for electric utility duct banks and structures must be signed and sealed by qualified electrical professional engineer responsible for their preparation. **Submit for action by Architect prior to submitting for approval by electric utility.**
- B. Submit Shop Drawings for electric utility duct banks and structures for action by Architect prior to submitting for approval by electric utility.

PART 2 - PRODUCTS

2.01 TYPE EPEC RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 651A and UL CCN EAZX.

B. Schedule 40 Electrical HDPE Underground Conduit (EPEC-40):

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Blue Diamond Industries, LLC.
 - b. JM Eagle.
 - c. Petroflex North America.
 - d. Prysmian Cables and Systems; Prysmian Group North America.
 - e. Southwire Company, LLC.
2. Standards:
 - a. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant.
3. Dimensional Specifications: Schedule 40.
4. Options:
 - a. Minimum Trade Size: **Metric designator 21 (trade size 3/4).**

C. Schedule 80 Electrical HDPE Underground Conduit (EPEC-80):

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Blue Diamond Industries, LLC.
 - b. JM Eagle.
 - c. Petroflex North America.
 - d. Prysmian Cables and Systems; Prysmian Group North America.
 - e. Southwire Company, LLC.
2. Standards:
 - a. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant.
3. Dimensional Specifications: Schedule 80.
4. Options:
 - a. Minimum Trade Size: **Metric designator 21 (trade size 3/4).**

D. Type A Electrical HDPE Underground Conduit (EPEC-A):

1. Dimensional Specifications: Type A.
2. Options:

- a. Minimum Trade Size: **Metric designator 21 (trade size 3/4).**
- E. Type B Electrical HDPE Underground Conduit (EPEC-B):
 - 1. Dimensional Specifications: Type B.
 - 2. Options:
 - a. Minimum Trade Size: **Metric designator 21 (trade size 3/4).**

2.02 TYPE ERM-SS RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 6A and UL CCN DYWV.
- B. Stainless Steel Electrical Rigid Metal Conduit (ERM-SS), Elbows, Couplings, and Nipples:
 - 1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. [ABB Electrification Installations Products.](#)
 - b. [Allied Tube & Conduit; Atkore International.](#)
 - c. [Calconduit; Atkore International.](#)
 - d. [Crouse-Hinds; brand of Eaton, Electrical Sector.](#)
 - e. [Patriot Aluminum Products, LLC.](#)
 - 2. Standards:
 - a. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant.
 - 3. Material: Stainless steel.
 - 4. Options:
 - a. Minimum Trade Size: **Metric designator 21 (trade size 3/4).**
 - b. Colors: As indicated on Drawings.

2.03 TYPE ERM-S RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 6 and UL CCN DYIX.
- B. Galvanized-Steel Electrical Rigid Metal Conduit (ERM-S-G), Elbows, Couplings, and Nipples:
 - 1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- a. [Allied Tube & Conduit; Atkore International.](#)
 - b. [Calconduit; Atkore International.](#)
 - c. [Crouse-Hinds; brand of Eaton, Electrical Sector.](#)
 - d. [Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated.](#)
 - e. [Patriot Aluminum Products, LLC.](#)
 - f. [Republic Conduit; Nucor Corporation, Nucor Tubular Products.](#)
 - g. [Topaz Lighting & Electric.](#)
 - h. [Wheatland Tube; Zekelman Industries.](#)
 2. Standards:
 - a. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant.
 3. Exterior Coating: Zinc.
 4. Options:
 - a. Interior Coating: **Zinc with organic top coating** or **Zinc.**
 - b. Minimum Trade Size: **Metric designator 21 (trade size 3/4).**
 - c. Colors: As indicated on Drawings.
- C. PVC-Coated-Steel Electrical Rigid Metal Conduit (ERMC-S-PVC), Elbows, Couplings, and Nipples:
1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. [ABB Electrification Installations Products.](#)
 - b. [Bluesteel Services LLC.](#)
 - c. [Calbond; Atkore International.](#)
 - d. [KorKap; Robroy Industries.](#)
 - e. [Perma-Cote; Robroy Industries.](#)
 - f. [Plasti-Bond; Robroy Industries.](#)
 2. Standards:
 - a. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant.
 3. Additional Characteristics:
 4. Fittings for PVC-Coated Conduit:
 - a. Minimum coating thickness of **0.040 inch (1 mm)**, with overlapping sleeves protecting threaded joints.
 - b. Conduit bodies must be Form 8 with effective seal and positive placement feature to ease and assure proper installation. Certified results confirming seal performance at 15 psig (positive) and 25 inch Hg (vacuum) for 72 hours must be available. Conduit bodies must be supplied with plastic-encapsulated stainless steel cover screws.
 - c. Form **2 inch (51 mm)** long or one pipe diameter long, whichever is less, PVC sleeve at openings of female fittings, except unions. Inside sleeve diameter must be matched to outside diameter of metal conduit.
 - d. PVC coating on outside of conduit couplings must be protected from tool damage during installation.

- e. Female threads on fittings and couplings must be protected by urethane coating.
 - f. Fittings must be from same manufacturer as conduit.
 - g. Beam clamps and U bolts must be formed and sized to fit outside diameter of coated conduit. Plastic-encapsulated nuts must cover exposed portions of threads.
5. Options:
- a. Exterior Coating: PVC complying with NEMA RN 1.
 - b. Interior Coating: **Zinc with organic top coating** or **Zinc**.
 - c. Minimum Trade Size: **Metric designator 21 (trade size 3/4)**.
 - d. Colors: As indicated on Drawings.
 - e. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
 - f. Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.

2.04 TYPE IMC RACEWAYS

A. Performance Criteria:

- 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- 2. General Characteristics: UL 1242 and UL CCN DYBY.

B. Steel Electrical Intermediate Metal Conduit (IMC):

- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. ABB Electrification Installations Products.
 - b. Allied Tube & Conduit; Atkore International.
 - c. Calconduit; Atkore International.
 - d. Republic Conduit; Nucor Corporation, Nucor Tubular Products.
 - e. Topaz Lighting & Electric.
 - f. Western Tube; Zekelman Industries.
 - g. Wheatland Tube; Zekelman Industries.
- 2. Standards:
 - a. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant.
- 3. Options:
 - a. Exterior Coating: **Zinc** or **Alternative corrosion-resistant coating**.
 - b. Interior Coating: **Zinc with organic top coating** or **Zinc**.
 - c. Minimum Trade Size: **Metric designator 21 (trade size 3/4)**.
 - d. Colors: As indicated on Drawings.

2.05 TYPE PVC RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 2. General Characteristics: UL 651 and UL CCN DZYR.
- B. Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings:
1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. [ABB Electrification Installations Products.](#)
 - b. [Calconduit; Atkore International.](#)
 - c. [JM Eagle.](#)
 - d. [NAPCO; Westlake Chemical Corp.](#)
 - e. National Pipe & Plastics; a CRH Company.
 - f. [Opti-Com Manufacturing Network, Inc \(OMNI\).](#)
 - g. [Topaz Lighting & Electric.](#)
 2. Standards:
 - a. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant.
 3. Dimensional Specifications: Schedule 40.
 4. Options:
 - a. Minimum Trade Size: **Metric designator 21 (trade size 3/4).**
 - b. Markings: **For use with maximum 90 deg C wire or for directional boring applications.**
- C. Schedule 80 Rigid PVC Conduit (PVC-80) and Fittings:
1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. [ABB Electrification Installations Products.](#)
 - b. [Calconduit; Atkore International.](#)
 - c. [JM Eagle.](#)
 - d. National Pipe & Plastics; a CRH Company.
 - e. [Opti-Com Manufacturing Network, Inc \(OMNI\).](#)
 - f. [Topaz Lighting & Electric.](#)
 2. Standards:
 - a. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant.
 3. Dimensional Specifications: Schedule 80.
 4. Options:
 - a. Minimum Trade Size: **Metric designator 21 (trade size 3/4).**
 - b. Markings: **For use with maximum 90 deg C wire or for directional boring applications.**
- D. Type A Rigid PVC Concrete-Encased Conduit (PVC-A) and Fittings:

1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. **Southern Pipe, Inc.**
 2. Standards:
 - a. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant.
 3. Dimensional Specifications: Type A.
 4. Options:
 - a. Minimum Trade Size: **Metric designator 21 (trade size 3/4).**
- E. Type EB Rigid PVC Concrete-Encased Underground Conduit (PVC-EB) and Fittings:
1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. **JM Eagle.**
 - b. **Southern Pipe, Inc.**
 2. Standards:
 - a. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant.
 3. Dimensional Specifications: Type EB.
 4. Options:
 - a. Minimum Trade Size: **Metric designator 78 (trade size 3).**

2.06 TYPE RTRC-BG RACEWAYS AND FITTINGS

- A. Performance Criteria:
1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 2. General Characteristics: UL 2420 and UL CCN DZKT, for Type BG.
- B. Low-Halogen, Belowground Reinforced Thermosetting Resin Conduit (RTRC-BG) and Fittings:
1. Options:
 - a. Minimum Trade Size: **Metric designator 21 (trade size 3/4).**

2.07 FITTINGS FOR CONDUIT, TUBING, AND CABLE

- A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- B. Metallic Fittings for Type ERM, Type IMC, Type PVC, Type EPEC, and Type RTRC Raceways:
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. ABB Electrification Installations Products.
 - b. Appleton; Emerson Electric Co., Automation Solutions.
 - c. Crouse-Hinds; brand of Eaton, Electrical Sector.
 - d. Konkore Fittings; Atkore International.
 - e. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
 - f. Penn Aluminum Conduit & EMT; Penn Aluminum International LLC; Berkshire Hathaway.
 - g. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - h. Southwire Company, LLC.
 - i. Topaz Lighting & Electric.
 2. Standards:
 - a. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant.
 3. General Characteristics: UL 514B and UL CCN DWTT.
 4. Options:
 - a. Material: **Steel** or **Die cast.**
 - b. Coupling Method: **Compression coupling, Raintight compression coupling with distinctive color gland nut, or Setscrew coupling. Setscrew couplings with only single screw per conduit are unacceptable.**
 - c. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
 - d. Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.

2.08 ELECTRICALLY CONDUCTIVE CORROSION-RESISTANT COMPOUNDS FOR THREADED CONDUIT

- A. Performance Criteria:
 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 2. General Characteristics: UL Subject 2419 and UL CCN FOIZ.
- B. 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. [ABB Electrification Installations Products.](#)

C. Standards:

1. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant.

2.09 SOLVENT CEMENTS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: As recommended by conduit manufacturer in accordance with UL 514B and UL CCN DWTT.

2.10 DUCT ACCESSORIES

A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used, and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.

1. [Manufacturers:](#) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- a. [ABB Electrification Installations Products.](#)
- b. [Allied Tube & Conduit; Atkore International.](#)
- c. [Cantex Inc.](#)
- d. [IPEX USA LLC.](#)
- e. [PenCell Plastics; brand of Hubbell Utility Solutions; Hubbell Incorporated.](#)
- f. [Underground Devices, Inc.](#)

2. Standards:

- a. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant.

2.11 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics:
 - a. ASTM C858 for design and manufacturing processes.
 - b. SCTE 77.

B. Precast Concrete Handholes and Boxes:

1. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover must form top of enclosure and must have load rating consistent with that of handhole or box.
2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Elmhurst-Chicago Stone Co.
 - b. Oldcastle Infrastructure Inc.; CRH Americas.
 - c. Rinker Group, Ltd.
 - d. Riverton Concrete Products.
 - e. Smith-Midland Corporation.
 - f. Utility Concrete Products, LLC.
 - g. Utility Vault Co.
 - h. Wausau Tile, Inc.
3. Standards:
 - a. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant.
4. Configuration: Units must be designed for flush burial and have **open, closed, or integral closed** bottom unless otherwise indicated.
5. Frame and Cover:
 - a. Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
 - b. Weatherproof steel frame, with steel cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
 - c. Weatherproof steel frame, with concealed-hinge steel access door assembly; tamper-resistant, captive, cover-securing bolts; hold-open ratchet assembly; and recessed cover handle.
 - d. Weatherproof aluminum frame, with concealed-hinge aluminum access door assembly; tamper-resistant, captive, cover-securing bolts; hold-open ratchet assembly; and recessed cover handle.
 - e. Cover Finish: Nonskid finish must have minimum coefficient of friction of 0.50.
 - f. Cover Legend: Molded lettering, **"ELECTRIC"**.
6. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
 - a. Extension must provide increased depth of **12 inch (300 mm)**.
 - b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.
7. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at installation location with ground-water level at grade.
8. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus additional **12 inch (300 mm)** vertically and horizontally to accommodate alignment variations.

- a. **Splayed** or **Center window** location.
 - b. Knockout panels must be located no less than **6 inch (150 mm)** from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
 - c. Knockout panel opening must have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct.
 - d. Knockout panels must be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.
 - e. Knockout panels must be **1-1/2 to 2 inch (38 to 50 mm)** thick.
9. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
- a. Type and size: Match fittings to duct to be terminated.
 - b. Fittings must align with elevations of approaching duct and be located near interior corners of handholes to facilitate racking of cable.
 - c. Provide minimum of **one** cast end-bell or duct-terminating fitting of each size provided in each wall.
10. Handholes **12 inch wide by 24 inch long (300 mm wide by 600 mm long)** and larger must have inserts for cable racks and pulling-in irons installed before concrete is poured.

C. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover:

1. Description: Molded of sand, concrete, and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or combination.
2. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Armormcast Products Company; brand of Hubbell Utility Solutions; Hubbell Incorporated.
 - b. MacLean Highline.
 - c. NewBasis.
 - d. Oldcastle Infrastructure Inc.; CRH Americas.
 - e. Quazite; brand of Hubbell Utility Solutions; Hubbell Incorporated.
3. Standards:
 - a. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant.
4. Configuration: Units must be designed for flush burial and have **open, closed, or integral closed** bottom unless otherwise indicated.
5. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and installed location.
 - a. Cover Finish: Nonskid finish must have minimum coefficient of friction of 0.50.
 - b. Cover Legend: Molded lettering, **"ELECTRIC"**.
6. Conduit Entrance Provisions: Conduit-terminating fittings must mate with entering ducts for secure, fixed installation in enclosure wall.

7. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
8. Duct Entrance Provisions: Duct-terminating fittings must mate with entering duct for secure, fixed installation in enclosure wall.
9. Handholes **12 inch wide by 24 inch long (300 mm wide by 600 mm long)** and larger must have factory-installed inserts for cable racks and pulling-in irons.
10. Options:
 - a. Color: **Submit for approval by architect.**

D. Fiberglass Handholes and Boxes with Polymer Concrete Frame and Cover:

1. Description: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.
2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Armorcast Products Company; brand of Hubbell Utility Solutions; Hubbell Incorporated.
 - b. NewBasis.
 - c. Oldcastle Infrastructure Inc.; CRH Americas.
 - d. Quazite; brand of Hubbell Utility Solutions; Hubbell Incorporated.
3. Standards:
 - a. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant.
4. Configuration: Units must be designed for flush burial and have **open, closed, or integral closed** bottom unless otherwise indicated.
5. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
 - a. Cover Finish: Nonskid finish must have minimum coefficient of friction of 0.50.
 - b. Cover Legend: Molded lettering, **"ELECTRIC"**.
6. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
7. Duct Entrance Provisions: Duct-terminating fittings must mate with entering duct for secure, fixed installation in enclosure wall.
8. Handholes **12 inch wide by 24 inch long (300 mm wide by 600 mm long)** and larger must have factory-installed inserts for cable racks and pulling-in irons.
9. Options:
 - a. Color: Submit for approval by architect.

E. Fiberglass Handholes and Boxes:

1. Description: Molded of fiberglass-reinforced polyester resin, with covers made of **polymer concrete, reinforced concrete, cast iron, hot-dip galvanized-steel diamond plate, or reinforced fiberglass.**
 2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. MacLean Highline.
 - b. Nordic Fiberglass, Inc.
 - c. Oldcastle Infrastructure Inc.; CRH Americas.
 - d. Quazite; brand of Hubbell Utility Solutions; Hubbell Incorporated.
 3. Standards:
 - a. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant.
 4. Configuration: Units must be designed for flush burial and have **open, closed, or integral closed** bottom unless otherwise indicated.
 5. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
 - a. Cover Finish: Nonskid finish must have minimum coefficient of friction of 0.50.
 - b. Cover Legend: Molded lettering, **"ELECTRIC"**.
 6. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
 7. Duct Entrance Provisions: Duct-terminating fittings must mate with entering duct for secure, fixed installation in enclosure wall.
 8. Handholes **12 inch wide by 24 inch long (300 mm wide by 600 mm long)** and larger must have factory-installed inserts for cable racks and pulling-in irons.
 9. Options:
 - a. Color: Submit for approval by architect.
- F. High-Density Polyethylene (HDPE) Boxes:
1. Description: Injection molded of HDPE or copolymer-polypropylene. Cover must be made of **polymer concrete or hot-dip galvanized-steel diamond plate.**
 2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Nordic Fiberglass, Inc.
 - b. Oldcastle Infrastructure Inc.; CRH Americas.
 - c. PenCell Plastics; brand of Hubbell Utility Solutions; Hubbell Incorporated.
 - d. Quazite; brand of Hubbell Utility Solutions; Hubbell Incorporated.
 3. Standards:

- a. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant.
4. Configuration: Units must be designed for flush burial and have **open, closed, or integral closed** bottom unless otherwise indicated.
5. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
 - a. Cover Finish: Nonskid finish must have minimum coefficient of friction of 0.50.
 - b. Cover Legend: Molded lettering, **"ELECTRIC"**.
6. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
7. Duct Entrance Provisions: Duct-terminating fittings must be installed perpendicular to box wall and mate with entering duct for secure, fixed installation in enclosure wall without putting stress on box wall or fitting.
8. Options:
 - a. Color: Submit for approval by architect.

2.12 MANHOLES FOR EXTERIOR UNDERGROUND WIRING

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics:
 - a. ASTM C858 for design and manufacturing processes.
 - b. SCTE 77.

B. Precast Concrete Manholes:

1. Description: One-piece units and units with interlocking mating sections, complete with accessories, hardware, and features.
2. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. [Carder Concrete Products.](#)
 - b. [Elmhurst-Chicago Stone Co.](#)
 - c. [Oldcastle Infrastructure Inc.; CRH Americas.](#)
 - d. [Rinker Group, Ltd.](#)
 - e. [Riverton Concrete Products.](#)
 - f. Smith-Midland Corporation.
 - g. [Utility Concrete Products, LLC.](#)
 - h. [Utility Vault Co.](#)
 - i. [Wausau Tile, Inc.](#)
3. Standards:

- a. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant.
4. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus additional **12 inch (300 mm)** vertically and horizontally to accommodate alignment variations.
 - a. **Splayed or Center window** location.
 - b. Knockout panels must be located no less than **6 inch (150 mm)** from interior surfaces of walls, floors, or roofs of manholes, but close enough to corners to facilitate racking of cables on walls.
 - c. Knockout panel opening must have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct.
 - d. Knockout panel must be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.
 - e. Knockout panels must be **1-1/2 to 2 inch (38 to 50 mm)** thick.
5. Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
 - a. Type and size: Match fittings to duct to be terminated.
 - b. Fittings must align with elevations of approaching duct and be located near interior corners of manholes to facilitate racking of cable.
 - c. Provide minimum of **one** cast end-bell or duct-terminating fitting of each size provided in each wall.
6. Ground Rod Sleeve: Provide **3 inch (75 mm)** PVC sleeve in manhole floors **2 inch (50 mm)** from wall adjacent to, but not underneath, duct entering structure.
7. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at installation location with ground-water level at grade.
8. Source Quality Control: Test and inspect in accordance with ASTM C1037.
- C. Cast-in-Place Concrete Manholes:
 1. Description: Underground utility structures, constructed in place, complete with accessories, hardware, and features. Include concrete knockout panels for duct entrance and sleeve for ground rod.
 2. Additional Criteria: Comply with Section 03 30 00 "Cast-in-Place Concrete."

2.13 UTILITY STRUCTURE ACCESSORIES

- A. Description: Utility equipment and accessory items used for utility structure access and utility support, listed and labeled for intended use and application.
- B. 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. BILCO Company (The).
 2. Campbell Foundry Company.
 3. Carder Concrete Products.
 4. EJ Group, Inc.
 5. Elmhurst-Chicago Stone Co.

6. [McKinley Iron Works, Inc.](#)
7. [Neenah Foundry Company.](#)
8. [NewBasis.](#)
9. [Oldcastle Infrastructure Inc.; CRH Americas.](#)
10. [Osburn Associates, Inc.](#)
11. [Pennsylvania Insert Corporation.](#)

C. Standards:

1. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant.

D. Manhole Frames, Covers, and Chimney Components: Comply with structural design loading specified for manhole.

1. Frame and Cover: Weatherproof, **gray cast iron complying with ASTM A48/A48M, Class 30B** or **cast aluminum** with milled cover-to-frame bearing surfaces; diameter, **26 inch (660 mm)**.
 - a. Cover Finish: Nonskid finish must have minimum coefficient of friction of 0.50.
 - b. Special Covers: Recess in face of cover designed to accept finish material in paved areas.
2. Cover Legend: Cast in; selected to suit system.
 - a. Legend:
 - 1) "ELECTRIC-LV" for duct systems with power wires and cables for systems operating at 600 V and less.
 - 2) "ELECTRIC-HV" for duct systems with medium-voltage cables.
3. Manhole Chimney Components: Precast concrete rings with dimensions matched to those of roof opening.
 - a. Mortar for Chimney Ring and Frame and Cover Joints: Comply with ASTM C270, Type M, except for quantities less than **2.0 cu. ft (60 L)** where packaged mix complying with ASTM C387/C387M, Type M, may be used.
 - b. Seal joints watertight using preformed plastic or rubber complying with ASTM C990. Install sealing material in accordance with sealant manufacturers' published instructions.

E. Manhole Sump Frame and Grate: ASTM A48/A48M, Class 30B, gray cast iron.

F. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, **2 inch (50 mm)** diameter eye, and **1-by-4 inch (25-by-100 mm)** bolt.

1. Working Load Embedded in 6 inch (150 mm), 4000 psi (27.6 MPa) Concrete: **13,000 lbf (58 kN)** minimum tension.

G. Pulling Eyes in Nonconcrete Walls: Eyebolt with reinforced fastening, **1-1/4 inch (31 mm)** diameter eye, rated **2500 lbf (11 kN)** minimum tension.

- H. Pulling-in and Lifting Irons in Concrete Floors: **7/8 inch (22 mm)** diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; fastened to reinforcing rod; and with exposed triangular opening.
 - 1. Ultimate Yield Strength: **40,000 lbf (180 kN)** shear and **60,000 lbf (270 kN)** tension.
- I. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; **1/2 inch (13 mm)** ID by **2-3/4 inch (69 mm)** deep, flared to **1-1/4 inch (31 mm)** minimum at base.
 - 1. Tested Ultimate Pullout Strength: **12,000 lbf (53 kN)** minimum.
- J. Ground Rod Sleeve: **3 inch (75 mm)** PVC sleeve in manhole floors **2 inch (50 mm)** from wall adjacent to, but not underneath, ducts routed from facility.
- K. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless steel expander clip with **1/2 inch (13 mm)** bolt, **5300 lbf (24 kN)** rated pullout strength, and minimum **6800 lbf (30 kN)** rated shear strength.
- L. Steel Cable Rack Assembly: **Hot-rolled** or **Hot-dip** galvanized, except insulators.
 - 1. Stanchions: T-section or channel with provisions to connect to other sections or channels to form continuous unit; **1-1/2 inch (38 mm)** in width by nominal **24 inch (600 mm)** long; punched with 14 hook holes on **1-1/2 inch (38 mm)** centers for cable-arm attachment.
 - 2. Arms: **1-1/2 inch (38 mm)** wide, lengths ranging from **3 inch (75 mm)** with **450 lb (204 kg)** minimum capacity to **18 inch (450 mm)** with **250 lb (114 kg)** minimum capacity. Arms must have slots along full length for cable ties and be arranged for secure mounting in horizontal position at vertical locations on stanchions.
 - 3. Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.
- M. Nonmetallic Cable Rack Assembly: Components fabricated from nonconductive, fiberglass-reinforced polymer.
 - 1. Stanchions: Nominal **36 inch (900 mm)** high by **4 inch (100 mm)** wide, with provisions to connect to other sections to form continuous unit, with minimum of nine holes for arm attachment.
 - 2. Arms: Arranged for secure, drop-in attachment in horizontal position at locations on cable stanchions, and capable of being locked in position. Arms must be available in lengths ranging from **3 inch (75 mm)** with **450 lb (204 kg)** minimum capacity to **20 inch (500 mm)** with **250 lb (114 kg)** minimum capacity. Top of arm must be nominally **4 inch (100 mm)** wide, and arm must have slots along full length for cable ties.
- N. Fixed Manhole Ladders: Arranged for attachment to **roof or wall and floor** of manhole. Ladder and mounting brackets and braces must be fabricated from **nonconductive, structural-grade, fiberglass-reinforced resin** or **hot-dip galvanized steel**.
- O. Portable Manhole Ladders: UL-listed, heavy-duty wood or **fiberglass** specifically designed for portable use for access to electrical manholes. Length must be not less than distance from deepest manhole floor to grade plus **36 inch (900 mm)**. **Two** ladder(s) are required.
- P. Cover Hooks: **Heavy duty, designed for lifts 60 lbf (270 N) and greater**. **Two** ladders(s) are required.

2.14 DUCT SEALING

- 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. ABB Electrification Installations Products.
 2. American Polywater Corporation.
 3. CommScope, Inc.
 4. Gardner Bender; brand of ECM Industries LLC; division of nVent Electric plc.
 5. Ideal Industries, Inc.
 6. NSi Industries LLC.
 7. TE Connectivity Ltd.
- B. Standards:
1. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant.
- C. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as **35 deg F (2 deg C)**. Compound must be capable of withstanding temperature of **300 deg F (150 deg C)** without slump and adhering to clean surfaces of plastic ducts, metallic conduit, conduit and duct coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals. Duct sealing compound must be removable without damaging ducts or cables.
- D. Inflatable Duct-Sealing System: Wraparound inflatable bladder that seals ducts that are empty or containing conductors against air and water infiltration. System is suitable for use in steel, plastic, or concrete ducts and penetrations.

2.15 SOURCE QUALITY CONTROL

- A. Factory Tests for Handholes and Boxes:
1. Testing Administrator: **Engage** qualified structural testing agency to evaluate handholes and boxes.
 - a. Tests of materials must be performed by independent testing agency.
 - b. Strength tests of complete boxes and covers must be by independent testing agency or manufacturer. Qualified registered professional engineer must certify tests by manufacturer.
 2. Factory Tests and Inspections: Perform the following tests and inspections on handholes and boxes, by, or under supervision of, qualified electrical testing laboratory recognized by authorities having jurisdiction, before delivering to site. Affix label with name and date of **qualified testing laboratory's** certification of system compliance.
 - a. Precast Concrete Utility Structures: Test and inspect in accordance with ASTM C1037.
 - b. Polymer Concrete and Nonconcrete Handhole and Pull-Box Prototypes: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests must be for specified tier ratings of products supplied. Testing machine pressure gages must have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

3. Nonconforming Work:
 - a. Equipment that does not pass tests and inspections will be considered defective.
4. Factory Test Reports: Prepare and submit factory test and inspection reports.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Coordinate layout and installation of duct, duct bank, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in field. Notify Architect if there is conflict between areas of excavation and existing structures or archaeological sites to remain.
- B. Coordinate elevations of duct and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to manholes and handholes, and as approved by Architect.
- C. Clear and grub vegetation to be removed, and protect vegetation to remain in accordance with Section 31 10 00 "Site Clearing." Remove and stockpile topsoil for reapplication in accordance with Section 31 10 00 "Site Clearing."

3.02 SELECTION OF UNDERGROUND DUCTS

- A. Duct for Electrical Cables More Than 600 V: **PVC-80, EPEC-40, or EPEC-80**, concrete encased unless otherwise indicated.
- B. Duct for Electrical Feeders 600 V and Less: **PVC-80, PVC-40, EPEC-40, or EPEC-80 and concrete encased** unless otherwise indicated.
- C. Duct for Electrical Branch Circuits: **PVC-80, PVC-40, EPEC-40, or EPEC-80** direct buried unless otherwise indicated.
- D. Bored Underground Duct: **EPEC-40 or EPEC-80** unless otherwise indicated.
- E. Underground Ducts Crossing Paved Paths Walks and Driveways: **PVC-80 or PVC-40 encased in reinforced concrete**.
- F. Underground Ducts Crossing Roadways and Railroads: **PVC-80 or PVC-40**, encased in reinforced concrete.
- G. Stub-ups: Concrete encased, **PVC-80, PVC-40, ERM-S, ERM-S-PVC, or IMC**.

3.03 SELECTION OF UNDERGROUND ENCLOSURES

- A. Handholes and Boxes:

1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete, AASHTO HB 17, **H-10** structural load rating.
2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: **Precast concrete, AASHTO HB 17, H-20** structural load rating.
3. Units in Sidewalk and Similar Applications with Safety Factor for Nondeliberate Loading by Vehicles: **Precast concrete, AASHTO HB 17, H-10** structural load rating.
4. Units Subject to Light-Duty Pedestrian Traffic Only: **Fiberglass-reinforced polyester resin** or **High-density plastic**, structurally tested in accordance with SCTE 77 with **3000 lbf (13 345 N)** vertical loading.
5. Cover design load must not exceed load rating of handhole or box.

B. Manholes: **Precast or cast-in-place** concrete.

1. Units Located in Roadways and Other Deliberate Traffic Paths by Heavy or Medium Vehicles: H-20 structural load rating in accordance with AASHTO HB 17.
2. Units Not Located in Deliberate Traffic Paths by Heavy or Medium Vehicles: H-10 load rating in accordance with AASHTO HB 17.

3.04 EARTHWORK

- A. Excavation and Backfill: Comply with Section 31 20 00 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restoration: Restore area **after construction vehicle traffic in immediate area is complete**.
- C. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- D. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Section 32 92 00 "Turf and Grasses" and Section 32 93 00 "Plants."
- E. Cut and patch existing pavement in path of underground duct, duct bank, and underground structures in accordance with "Cutting and Patching" Article in Section 01 73 00 "Execution."

3.05 INSTALLATION OF DUCTS AND DUCT BANKS

- A. Reference Standards:
 1. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NEMA TCB 2 for installation of underground ducts and duct banks.
 2. Consult Architect for resolution of conflicting requirements.
- B. Special Techniques:
 1. Where indicated on Drawings, install duct, spacers, and accessories into duct-bank configuration shown. Duct installation requirements in this Section also apply to duct bank.
 2. Steel raceway, bends, and fittings in **on Project** must be of same type.

3. Slope: Pitch duct minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope duct from high point between two manholes to drain in both directions.
4. Expansion and Deflection Fittings: Install expansion and deflection fitting in each duct in area of disturbed earth adjacent to manhole or handhole.
5. Install expansion fitting near center of straight line duct with calculated expansion of more than **3/4 inch (19 mm)**.
6. Curves and Bends:
 - a. Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with minimum radius of **48 inch (1200 mm)**, both horizontally and vertically, at other locations unless otherwise indicated.
 - b. Field bending must be in accordance with NFPA 70 minimum radii requirements, except bends over 45 degrees must be made with minimum radius of **48 inch (1200 mm)**. Use only equipment specifically designed for material and size involved. Use PVC heating bender for bending PVC conduit.
 - c. Duct must have maximum of 180 degrees of bends between pull points.
7. Joints: Use solvent-cemented joints in nonmetallic duct and fittings and make watertight in accordance with manufacturer's published instructions. Stagger couplings so those of adjacent duct do not lie in same plane. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with minimum **3 inch (75 mm)** of concrete for minimum of **12 inch (300 mm)** on each side of coupling.
 - a. Install insulated grounding bushings on steel raceway terminations that are less than **12 inch (300 mm)** below grade or floor level and do not terminate in hubs.
8. Installation Adjacent to High-Temperature Steam Lines: Where duct is installed parallel to underground steam lines, perform calculations showing duct will not be subject to environmental temperatures above **104 deg F (40 deg C)**. Where environmental temperatures are calculated to rise above **104 deg F (40 deg C)**, and anywhere duct crosses above underground steam line, install insulation blankets listed for direct burial to isolate duct bank from steam line to maintain maximum environmental temperature of **104 deg F (40 deg C)**.
9. End Bell Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately **10 inch (250 mm)** o.c. for **5 inch (125 mm)** duct, and vary proportionately for other duct sizes.
 - a. Begin change from regular spacing to end-bell spacing **10 ft (3 m)** from end bell, without reducing duct slope and without forming trap in line.
 - b. Grout end bells into structure walls from both sides to provide watertight entrances.
10. Duct Terminators for Entrances to Cast-in-Place Manholes and Concrete Handholes: Use manufactured, cast-in-place duct terminators, with entrances into structure spaced approximately **6 inch (150 mm)** o.c. for **4 inch (100 mm)** duct, and vary proportionately for other duct sizes.
 - a. Begin change from regular spacing to terminator spacing **10 ft (3 m)** from terminator, without reducing duct line slope and without forming trap in line.

11. Building Wall Penetrations: Make transition from underground duct to steel raceway at least **10 ft (3 m)** outside building wall, without reducing duct line slope away from building and without forming trap in line. Use fittings manufactured for transition to steel raceway type installed. Install steel raceway penetrations of building walls as specified in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
12. Install manufactured steel raceway elbows for stub-ups at poles unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
 - a. Couple steel elbows to ducts with adapters designed for this purpose, and encase coupling with minimum **3 inch (75 mm)** of concrete for minimum of **12 inch (300 mm)** on each side of coupling.
13. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least **15 psig (1.03 MPa)** hydrostatic pressure.
14. Pulling Cord: Install **200 lbf (1000 N)** test nylon cord in empty ducts.
15. Concrete-Encased Ducts and Duct Bank:
 - a. Excavate trench bottom to provide firm and uniform support for duct. Prepare trench bottoms as specified in Section 31 20 00 "Earth Moving" for pipes **6 inch (150 mm)** or less in nominal diameter.
 - b. Width: Excavate trench **12 inch (300 mm)** wider than duct on each side.
 - c. Depth: Install so top of duct envelope is at least **24 inch (600 mm)** below finished grade in areas not subject to deliberate traffic, and at least **30 inch (750 mm)** below finished grade in deliberate traffic paths for vehicles unless otherwise indicated. Install so top of duct envelope is below local frost line.
 - d. Support duct on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
 - e. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than **five** spacers per **20 ft (6 m)** of duct. Place spacers within **24 inch (600 mm)** of duct ends. Stagger spacers approximately **6 inch (150 mm)** between tiers. Secure spacers to earth and to duct to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
 - f. Minimum Space between Ducts: **3 inch (75 mm)** between edge of duct and exterior envelope wall, **2 inch (50 mm)** between ducts for like services, and **4 inch (100 mm)** between power and communications ducts.
 - g. Elbows:
 - 1) Use manufactured duct elbows for stub-ups and at changes of direction in duct unless otherwise indicated. Extend encasement throughout length of elbow.
 - 2) Use manufactured steel elbows for stub-ups, at building entrances, and at changes of direction in duct run.
 - h. Stub-ups to Outdoor Equipment: Extend concrete-encased steel raceway horizontally minimum of **60 inch (1500 mm)** from edge of equipment base.

- 1) Stub-ups must **terminate in coupling installed flush with** finished floor and minimum **3 inch (75 mm)** from conduit side to edge of slab.
 - i. Stub-ups to Indoor Equipment: Extend concrete-encased steel raceway horizontally minimum of **60 inch (1500 mm)** from edge of wall. Install insulated grounding bushings on terminations at equipment.
 - 1) Stub-ups must **terminate in coupling installed flush with** finished floor and no less than **3 inch (75 mm)** from conduit side to edge of slab.
 - j. Reinforcement: Reinforce concrete-encased duct where crossing disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
 - k. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
 - l. Concrete Cover: Install minimum of **3 inch (75 mm)** of concrete cover between edge of duct to exterior envelope wall, **2 inch (50 mm)** between duct of like services, and **4 inch (100 mm)** between power and communications ducts.
 - m. Place minimum **6 inch (150 mm)** of engineered fill above concrete encasement of duct.
 - n. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
 - 1) Start at one end and finish at other, allowing for expansion and contraction of duct as its temperature changes during and after pour. Use expansion fittings installed in accordance with manufacturer's published instructions, or use other specific measures to prevent expansion-contraction damage.
 - 2) If more than one pour is necessary, terminate each pour in vertical plane and install **3/4 inch (15 mm)** reinforcing-rod dowels extending minimum of **18 inch (450 mm)** into concrete on both sides of joint near corners of envelope.
 - o. Pouring Concrete: Comply with requirements in "Concrete Placement" Article in Section 03 30 00 "Cast-in-Place Concrete." Place concrete carefully during pours to prevent voids under and between duct and at exterior surface of envelope. Do not allow heavy mass of concrete to fall directly onto ducts. Allow concrete to flow around duct and rise up in middle, uniformly filling open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-installation application.
16. Direct-Buried Duct and Duct Bank:
- a. Excavate trench bottom to provide firm and uniform support for duct. Comply with requirements in Section 31 20 00 "Earth Moving" for preparation of trench bottoms for pipes less than **6 inch (150 mm)** in nominal diameter.
 - b. Width: Excavate trench **12 inch (300 mm)** wider than duct on each side.
 - c. Depth: Install top of duct at least **36 inch (900 mm)** below finished grade unless otherwise indicated.
 - d. Set elevation of top of duct bank below frost line.
 - e. Place minimum **3 inch (75 mm)** of sand as bed for duct. Place sand to minimum of **6 inch (150 mm)** above top level of duct.

- f. Support ducts on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
- g. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than **five** spacers per **20 ft (6 m)** of duct. Place spacers within **24 inch (600 mm)** of duct ends. Stagger spacers approximately **6 inch (150 mm)** between tiers. Secure spacers to earth and to ducts to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
- h. Install duct with minimum of **3 inch (75 mm)** between ducts for like services and **6 inch (150 mm)** between power and communications duct.
- i. Install manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct direction unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
- j. Install manufactured steel elbows for stub-ups, at building entrances, and at changes of direction in duct.
 - 1) Couple RNC duct to steel raceway with adapters designed for this purpose, and encase coupling with minimum **3 inch (75 mm)** of concrete.
 - 2) Stub-ups to Outdoor Equipment: Extend concrete-encased steel raceway horizontally minimum of **60 inch (1500 mm)** from edge of base. Install insulated grounding bushings on terminations at equipment.
 - a) Stub-ups must **terminate in coupling installed flush with** finished base and minimum **3 inch (75 mm)** from conduit side to edge of base.
 - 3) Stub-ups to Indoor Equipment: Extend concrete-encased steel raceway horizontally on exterior of wall minimum of **60 inch (1500 mm)** from edge of wall. Install insulated grounding bushings on terminations at equipment.
 - 4) Stub-ups through interior floors must **terminate in coupling installed flush with** finished floor and no less than **3 inch (75 mm)** from conduit side to edge of equipment pad or floor slab.
- k. After installing first tier of duct, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to **4 inch (100 mm)** over duct and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Section 31 20 00 "Earth Moving" for installation of backfill materials.
- 17. Warning Planks: Bury warning planks approximately **12 inch (300 mm)** above direct-buried duct, placing them **36 inch (900 mm)** o.c. Align planks along width and along centerline of duct or duct bank. Provide additional plank for each **12 inch (300 mm)** increment of duct-bank width over nominal **18 inch (450 mm)**. Space additional planks **12 inch (300 mm)** apart, horizontally across width of ducts.
- 18. Underground-Line Warning Tape: Bury **nonconducting** underground line specified in Section 26 05 53 "Identification for Electrical Systems" no less than **12 inch (300 mm)** above concrete-encased duct and duct banks and **approximately 12 inch (300 mm) below grade**. Align tape parallel to and within **3 inch (75 mm)** of centerline of duct bank. Provide additional warning tape for each **12 inch (300 mm)** increment of duct-bank width

- over nominal 18 inch (450 mm). Space additional tapes 12 inch (300 mm) apart, horizontally across width of ducts.
19. Ground ducts and duct banks in accordance with Section 26 05 26 "Grounding and Bonding for Electrical Systems."

3.06 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

A. Reference Standards:

1. Precast Concrete Handholes: Comply with ASTM C891 unless otherwise indicated.
2. Consult Architect for resolution of conflicting requirements.

B. Special Techniques:

1. Cast-in-Place Manholes:
 - a. Finish interior surfaces with smooth-troweled finish.
 - b. Knockouts for Future Duct Connections: Form and pour concrete knockout panels 1-1/2 to 2 inch (38 to 50 mm) thick, arranged as indicated.
 - c. Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for cast-in-place concrete, formwork, and reinforcement.
2. Precast Concrete Handholes and Manholes:
 - a. Install units level and plumb and with orientation and depth coordinated with connecting duct to minimize bends and deflections required for proper entrances.
 - b. Unless otherwise indicated, support units on level bed of crushed stone or gravel graded from 1 inch (25 mm) sieve to No. 4 (4.75 mm) sieve and compacted to same density as adjacent undisturbed earth.
 - c. Field-cut openings for conduits in accordance with enclosure manufacturer's published instructions. Cut wall of enclosure with tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
3. Elevations:
 - a. Manhole Roof: Install with rooftop at least 15 inch (375 mm) below finished grade.
 - b. Manhole Frame: In paved areas and trafficways, set frames flush with finished grade. Set other manhole frames 1 inch (25 mm) above finished grade.
 - c. Install handholes with bottom below frost line, below grade.
 - d. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.
 - e. Where indicated, cast handhole cover frame integrally with handhole structure.
4. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.
5. Manhole Access: Circular opening in manhole roof; sized to match cover size.
 - a. Manholes with Fixed Ladders: Offset access opening from manhole centerlines to align with ladder.

- b. Install chimney, constructed of **precast concrete** or **cast-iron** collars and rings, and cast-iron frame to connect cover with manhole roof opening. Provide moisture-tight joints and waterproof grouting for frame and chimney.
6. Waterproofing: Apply waterproofing to exterior surfaces of manholes **and handholes** after concrete has cured at least three days. Waterproofing materials and installation are specified in **Section 07 13 53 "Elastomeric Sheet Waterproofing" or Section 07 13 54 "Thermoplastic Sheet Waterproofing"**. After duct has been connected and grouted, and before backfilling, waterproof joints and connections, and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.
7. Dampproofing: Apply dampproofing to exterior surfaces of manholes **and handholes** after concrete has cured at least three days. Dampproofing materials and installation are specified in Section 07 11 13 "Bituminous Dampproofing." After ducts are connected and grouted, and before backfilling, dampproof joints and connections, and touch up abrasions and scars. Dampproof exterior of manhole chimneys after mortar has cured at least three days.
8. Hardware: Install removable hardware, including pulling eyes, cable stanchions, **and cable arms, and insulators**, as required for installation and support of cables and conductors and as indicated.
9. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.
10. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than **3-7/8 inch (97 mm)** for manholes and **2 inch (50 mm)** for handholes, for anchor bolts installed in field. Use minimum of two anchors for each cable stanchion.
11. Ground manholes, handholes, and boxes in accordance with Section 26 05 26 "Grounding and Bonding for Electrical Systems."

3.07 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Reference Standards:

1. Consult Architect for resolution of conflicting requirements.

B. Special Techniques:

1. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of duct, and seal joint between box and extension as recommended by manufacturer.
2. Unless otherwise indicated, support units on level bed of crushed stone or gravel, graded from **1/2 inch (12.5 mm)** sieve to **No. 4 (4.75 mm)** sieve and compacted to same density as adjacent undisturbed earth.
3. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes **1 inch (25 mm)** above finished grade.
4. Install handholes and boxes with bottom below frost line, below grade.
5. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as

- indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.
6. Field cut openings for duct in accordance with enclosure manufacturer's published instructions. Cut wall of enclosure with tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
 7. For enclosures installed in **asphalt paving** and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour concrete ring encircling, and in contact with enclosure entry, and with top surface screeded to top of box cover frame. Bottom of ring must rest on **compacted earth**.
 - a. Concrete: **3000 psi (20 kPa)**, 28-day strength, complying with Section 03 30 00 "Cast-in-Place Concrete," with troweled finish.
 - b. Dimensions: **10 inch wide by 12 inch deep (250 mm wide by 300 mm deep)**.
 8. Ground handholes and boxes in accordance with Section 26 05 26 "Grounding and Bonding for Electrical Systems."

3.08 FIELD QUALITY CONTROL

- A. Field tests and inspections must be witnessed by **authorities having jurisdiction**.
- B. Tests and Inspections:
 1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, duct bank, and utility structures.
 2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide minimum **12 inch (300 mm)** long mandrel equal to duct size minus **1/4 inch (6 mm)**. If obstructions are indicated, remove obstructions and retest.
 3. Test manhole **and handhole** grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- C. Nonconforming Work:
 1. Underground ducts, raceways, and structures will be considered defective if they do not pass tests and inspections.
 2. Correct deficiencies and retest as specified above to demonstrate compliance.
- D. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.
- E. Manufacturer Services: Engage factory-authorized service representative to **support** field tests and inspections.
 1. Manufacturer's Field Reports for Field Quality-Control Support: Prepare and submit report after each visit by factory-authorized service representative, documenting activities performed at Project site.

3.09 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump, and building interiors affected by Work.
 - 1. Sweep floor, removing dirt and debris.
 - 2. Remove foreign material.

END OF SECTION

SECTION 26 05 44

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. Section Includes:
 - 1. Sleeves for cable penetration of non-fire-rated construction walls and floors.
 - 2. Sleeve-seal systems.
 - 3. Sleeve-seal fittings.
 - 4. Grout.
 - 5. Silicone sealants.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.01 ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant

2.02 SLEEVES

- A. Wall Sleeves:
 - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
 - 2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Sleeves for Rectangular Openings:
 - 1. Material: Galvanized sheet steel.
 - 2. Minimum Metal Thickness:

- a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
- b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.03 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. [Advance Products & Systems, Inc.](#)
 - b. [CALPICO, Inc.](#)
 - c. [Metraflex Company \(The\).](#)
 - d. [Pipeline Seal and Insulator, Inc.](#)
 - e. [Proco Products, Inc.](#)
 2. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant
 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 or Stainless steel of length required to secure pressure plates to sealing elements.

2.04 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. [Presealed Systems.](#)

2.05 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

- D. Packaging: Premixed and factory packaged.

2.06 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Cables Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07.
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
 - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Cables Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel or cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

- F. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.03 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

SECTION 26 05 48

SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. Section Includes:
 - 1. Restraint channel bracings.
 - 2. Restraint cables.
 - 3. Seismic-restraint accessories.
 - 4. Mechanical anchor bolts.
 - 5. Adhesive anchor bolts.
- B. Related Requirements:
 - 1. Section 26 05 29 "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. 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 agency acceptable to authorities having jurisdiction.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
- 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 qualified professional engineer responsible for their preparation.
 - 2. Design Calculations: Calculate static and dynamic loading caused by equipment weight, operation, and seismic forces required to select seismic restraints and for designing vibration isolation bases.

- a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
- 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 agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.04 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 reports.

1.05 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis. They shall bear anchorage preapproval from OSHPD in addition to preapproval, showing maximum seismic-restraint ratings, by ICC-ES or another agency acceptable to authorities having jurisdiction. 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) that support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
- D. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. See Structural Design.
- B. The following components are Ip= 1.5:
 - 1. Fire alarm system
 - 2. Generator and emergency power distribution system.
- C. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant

2.02 RESTRAINT CHANNEL BRACINGS

- 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. [Cooper B-Line, Inc.; a Division of Cooper Industries.](#)
 - 2. [Hilti, Inc.](#)
 - 3. [Mason Industries, Inc.](#)
 - 4. [Unistrut; 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, with other matching components, and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.03 RESTRAINT CABLES

- 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. [Kinetics Noise Control, Inc.](#)
 - 2. [Loos & Co., Inc.](#)
 - 3. [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.

2.04 SEISMIC-RESTRAINT ACCESSORIES

- 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. [Cooper B-Line, Inc.; a Division of Cooper Industries.](#)
 - 2. [Kinetics Noise Control, Inc.](#)
 - 3. [Mason Industries, Inc.](#)
 - 4. [TOLCO; a brand of NIBCO INC.](#)

- B. Hanger-Rod Stiffener:
 - 1. Steel tube or steel slotted-support-system sleeve with internally bolted connections.
 - 2. 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.

2.05 MECHANICAL ANCHOR BOLTS

- 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. [Cooper B-Line, Inc.; a Division of Cooper Industries.](#)
 - 2. [Hilti, Inc.](#)
 - 3. [Kinetics Noise Control, Inc.](#)
 - 4. [Mason Industries, Inc.](#)
- B. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in 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.

2.06 ADHESIVE ANCHOR BOLTS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. [Hilti, Inc.](#)
 - 2. [Kinetics Noise Control, Inc.](#)
 - 3. [Mason Industries, Inc.](#)
- B. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC 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.

PART 3 - EXECUTION

3.01 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 for reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLICATIONS

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. 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.

3.03 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. Equipment and Hanger Restraints:
 - 1. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
 - 2. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. 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.
- 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.
- F. 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.

3.04 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 connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.05 FIELD QUALITY CONTROL

- A. Perform the following 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.
- B. Seismic controls will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.06 ADJUSTING

- A. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. Section Includes:
 - 1. Identification for conductors.
 - 2. Underground-line warning tape.
 - 3. Warning labels and signs.
 - 4. Equipment identification labels.
 - 5. Miscellaneous identification products.

1.03 ACTION SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.04 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.

1.05 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

2.01 ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant

2.02 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than **3 mils (0.08 mm)** thick by **1 to 2 inches (25 to 50 mm)** wide.
- B. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, **3-mil- (0.08-mm-)** 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 conductor diameter such that the clear shield overlaps the entire printed legend.
- C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of conductor it identifies and to stay in place by gripping action.
- D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve with diameter sized to suit diameter of conductor it identifies and to stay in place by gripping action.
- E. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- F. Write-On Tags: Polyester tag, **0.015 inch (0.38 mm)** thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Labels for Tags: Self-adhesive label, machine-printed with permanent, waterproof, black ink recommended by printer manufacturer, sized for attachment to tag.

2.03 UNDERGROUND-LINE WARNING TAPE

- A. Tape:
 - 1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - 2. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - 3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
 - 4. Pigmented polyolefin, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
 - 5. Thickness: **4 mils (0.1 mm)**.
 - 6. Weight: **18.5 lb/1000 sq. ft. (9.0 kg/100 sq. m)**.

7. **3-Inch (75-mm)** Tensile According to ASTM D 882: **30 lbf (133.4 N)**, and **2500 psi (17.2 MPa)**.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: **ELECTRIC LINE, HIGH VOLTAGE,**.
3. Inscriptions for Orange-Colored Tapes: **TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE,**.

2.04 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. **1/4-inch (6.4-mm)** grommets in corners for mounting.
3. Nominal size, **7 by 10 inches (180 by 250 mm)**.

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with **0.0396-inch (1-mm)** galvanized-steel backing; and with colors, legend, and size required for application.
2. **1/4-inch (6.4-mm)** grommets in corners for mounting.
3. Nominal size, **10 by 14 inches (250 by 360 mm)**.

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD."

2.05 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum **1/16 inch (1.6 mm)** thick for signs up to **20 sq. inches (129 sq. cm)** and **1/8 inch (3.2 mm)** thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be **3/8 inch (10 mm)**.

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be **3/8 inch (10 mm)**. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.06 EQUIPMENT IDENTIFICATION LABELS

- A. 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 (10 mm)**.
- B. 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 (10 mm)**.

2.07 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.
 - 1. Minimum Width: **3/16 inch (5 mm)**.
 - 2. Tensile Strength at **73 deg F (23 deg C)**, According to ASTM D 638: **12,000 psi (82.7 MPa)**.
 - 3. Temperature Range: **Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C)**.
 - 4. Color: Black except where used for color-coding.

2.08 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. 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

3.01 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. 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.
- G. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at **6 to 8 inches (150 to 200 mm)** below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds **16 inches (400 mm)** overall.

3.02 IDENTIFICATION SCHEDULE

- A. 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, feeder, and branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 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 (150 mm)** from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- B. Power-Circuit Conductor Identification, More than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic plastic tag holder with adhesive-backed phase tags, and a separate tag with the circuit designation.
- C. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- D. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, self-adhesive, self-laminating polyester labels with the conductor or cable designation, origin, and destination.
- E. Control-Circuit Conductor Termination Identification: For identification at terminations provide self-adhesive, self-laminating polyester labels with the conductor designation.
- F. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.
- G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
 - 1. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- H. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- I. 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: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with **1/2-inch- (13-mm-)** high letters on **1-1/2-inch- (38-mm-)** high label; where two lines of text are required, use labels **2 inches (50 mm)** high.
- b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
- c. 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: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
- b. Enclosures and electrical cabinets.
- c. 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.

END OF SECTION

SECTION 26 08 00

COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. Section includes Cx process requirements for the following electrical components, systems, assemblies, and equipment:
 - 1. Electrical equipment connected to Normal power systems, including the following:
 - a. Motor-control centers.
 - b. Transformers.
 - c. **Primary and secondary** service electrical systems.
 - d. **Distribution and branch-circuit** panelboards.
 - e. Lightning protection systems.
 - f. Grounding systems.
 - 2. Electrical equipment connected to Essential power systems that provide an alternative source of power in the absence of power from the Normal power system, including the following:
 - a. Motor-control centers.
 - b. **Primary and secondary** service electrical systems.
 - c. **Distribution and branch-circuit** panelboards.
 - d. Lighting protection systems.
 - e. Grounding systems.
 - f. Generators.
 - g. UPS.
 - 3. Controls and instrumentation, including the following:
 - a. Equipment monitoring systems.
 - b. Energy monitoring and control systems.
 - c. Electrical metering and metering system.
 - d. Demand response systems.
 - e. Lighting control systems.
 - f. Security systems.
 - g. Fire-alarm systems.

4. Systems testing and verification, including **Normal and Essential** power systems, and **transitions from Normal to Essential power systems and back.**

B. Related Requirements:

1. Section 01 91 13 "General Commissioning Requirements" for general Cx process requirements and CxA responsibilities.

1.03 DEFINITIONS

- A. BoD: Basis-of-Design Document, as defined in Section 01 91 13 "General Commissioning Requirements."
- B. Cx: Commissioning, as defined in Section 01 91 13 "General Commissioning Requirements."
- C. CxA: Commissioning Authority, as defined in Section 01 91 13 "General Commissioning Requirements."
- D. Essential Power Systems: A power system that a facility transitions to in the absence of Normal power. This power includes all systems classified as "standby" or "emergency," including "legally required."
- E. Low Voltage: 600 V and below.
- F. Medium Voltage: 601 V and above.
- G. Normal Power Systems: A power system that provides primary power to a facility.
- H. OPR: Owner's Project Requirements, as defined in Section 01 91 13 "General Commissioning Requirements."
- I. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **BAS and electrical** testing technician.
- B. Construction Checklists: Draft construction checklists will be created by CxA for Contractor review.
- C. Construction Checklists: Include the following and comply with requirements in Section 01 91 13 "General Commissioning Requirements" for construction checklists:
 1. Instrumentation and control for electrical systems.
 2. Instrumentation and control for lighting control systems.
 3. Low-voltage power cables.
 4. Control voltage power cables.
 5. Electrical feeders and branch circuits.
 6. Liquid-filled transformers.
 7. Dry-type transformers.
 8. Instrument transformers.

9. Switchgear and switchboard assemblies rated 1200 A or greater.
10. Metal-enclosed bus duct.
11. Busway.
12. Motor-control centers.
13. Low-voltage motor starters.
14. Low-voltage air circuit breakers.
15. Low-voltage insulated case circuit breakers.
16. Low-voltage network protectors.
17. Low-voltage air switches.
18. Low-voltage surge protective devices.
19. Medium-voltage power cables.
20. Medium-voltage circuit breakers.
21. Medium-voltage motor starters.
22. Medium-voltage air circuit breakers.
23. Medium-voltage vacuum circuit breakers.
24. Medium-voltage SF6 (sulfur hexafluoride) circuit breakers.
25. Medium-voltage air switches.
26. Medium-voltage surge protective devices.
27. Protective relays.
28. Metering devices.
29. Molded-case circuit breakers.
30. Low-voltage power circuit breakers.
31. Grounding systems.
32. Ground-fault protection systems.
33. Panelboards.
34. Receptacles and devices.
35. Engine generators.
36. Automatic transfer switches.
37. Variable-frequency drives.
38. AC synchronous motors and generators.
39. AC induction motors and generators.
40. DC motors and generators.
41. Battery systems.
42. Battery chargers.
43. Flooded lead-acid batteries.
44. Flooded lead-calcium batteries.
45. VRLA batteries.
46. UPS systems.
47. Power factor correction equipment, including capacitors, dry-type reactors (both shunt and current-limiting), and liquid-filled reactors (both shunt and current-limiting).
48. Lighting.
49. Vehicle charging equipment.
50. <Insert equipment>.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For electrical systems and components to include in operation and maintenance manuals.

1.06 QUALITY ASSURANCE

- A. Electrical Testing Technician Qualifications: Technicians to perform electrical Construction Checklist verification tests, Construction Checklist verification test demonstrations, Cx tests, and Cx test demonstrations shall have the following minimum qualifications:
1. Journey level or equivalent skill level. Vocational school four-year-program graduate or an Associate's degree in electrical systems, or similar field. Degree may be offset by three years' experience as an apprentice or a journey-level electrician. Generally, required knowledge includes electrical and HVAC&R concepts, building operations, and application and use of tools and instrumentation to measure performance of electrical equipment, assemblies, and systems.
 2. Minimum **three years'** experience installing, servicing, and operating systems manufactured by approved manufacturer.
- B. Testing Equipment and Instrumentation Quality and Calibration: For test equipment and instrumentation required to perform electrical Cx work, perform the following:
1. Submit test equipment and instrumentation list. For each equipment or instrument, identify the following:
 - a. Equipment/instrument identification number.
 - b. Planned Cx application or use.
 - c. Manufacturer, make, model, and serial number.
 - d. Calibration history, including certificates from agencies that calibrate the equipment and instrumentation.
 2. Test equipment and instrumentation shall meet the following criteria:
 - a. Capable of testing and measuring performance within the specified acceptance criteria.
 - b. Be calibrated at manufacturer's recommended intervals with current calibration tags permanently affixed to the instrument being used.
 - c. Be maintained in good repair and operating condition throughout duration of use on Project.
 - d. Be recalibrated/repared if dropped or damaged in any way since last calibrated.
- C. Proprietary Test Instrumentation and Tools:
1. Equipment Manufacturer's Proprietary Instrumentation and Tools: For installed equipment included in the Cx process, test instrumentation and tools manufactured or prescribed by equipment manufacturer to service, calibrate, adjust, repair, or otherwise work on its equipment or required as a condition of equipment warranty, perform the following:
 - a. Submit proprietary instrumentation and tools list. For each instrument or tool, identify the following:
 - 1) Instrument or tool identification number.
 - 2) Equipment schedule designation of equipment for which the instrument or tool is required.
 - 3) Manufacturer, make, model, and serial number.
 - 4) Calibration history, including certificates from agencies that calibrate the instrument or tool, where appropriate.

- b. Include a separate list of proprietary test instrumentation and tools in operation and maintenance manuals.
- c. Electrical proprietary test instrumentation and tools become property of Owner at the time of Substantial Completion.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 CONSTRUCTION CHECKLISTS

- A. Prepare detailed construction checklists for electrical systems, subsystems, equipment, and components. Complete and submit construction checklists.

3.02 CONSTRUCTION CHECKLIST REVIEW

- A. Review and provide written comments on draft construction checklists. CxA will create required draft construction checklists and provide them to Contractor.
- B. Return draft Construction Checklist review comments within **10** days of receipt.
- C. When review comments have been resolved, CxA will provide final construction checklists, marked "Approved for Use, (date)."
- D. Use only construction checklists, marked "Approved for Use, (date)."

3.03 GENERAL TESTING REQUIREMENTS

- A. Certify that electrical systems, subsystems, and equipment have been installed, calibrated, and started and that they are operating according to the Contract Documents and approved Shop Drawings and submittals.
- B. Certify that electrical instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents and approved Shop Drawings and submittals, and that pretest set points have been recorded.
- C. Set systems, subsystems, and equipment into operating mode to be tested according to approved test procedures (for example, normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
- D. Measure capacities and effectiveness of systems, assemblies, subsystems, equipment, and components, including operational and control functions to verify compliance with acceptance criteria.
- E. Test systems, assemblies, subsystems, equipment, and components operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and response according to acceptance criteria.
- F. Construction Checklists: Prepare and submit detailed construction checklists for electrical systems, subsystems, equipment, and components.

1. Contributors to development of construction checklists shall include, but are not limited to, the following:
 - a. Electrical systems and equipment installers.
 - b. Electrical instrumentation and controls installers.
- G. Perform tests using design conditions, whenever possible.
 1. Simulated conditions may, with approval of Architect, be imposed using an artificial load when it is impractical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by CxA, and document simulated conditions and methods of simulation. After tests, return configurations and settings to normal operating conditions.
 2. Cx test procedures may direct that set points be altered when simulating conditions is impractical.
 3. Cx test procedures may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are impractical.
- H. If tests cannot be completed because of a deficiency outside the scope of the electrical system, document the deficiency and report it to Owner. After deficiencies are resolved, reschedule tests.
- I. If seasonal testing is specified, complete appropriate initial performance tests and documentation and schedule seasonal tests.
- J. Coordinate schedule with, and perform Cx activities at the direction of the CxA.
- K. Comply with Construction Checklist requirements, including material verification, installation checks, startup, and performance tests requirements specified in Sections specifying electrical systems and equipment.
- L. Provide technicians, instrumentation, tools, and equipment to complete and document the following:
 1. Performance tests.
 2. Demonstration of a sample of performance tests.
 3. Cx tests.
 4. Cx test demonstrations.

3.04 Cx TESTS FOR ELECTRICAL SYSTEMS

- A. Verification of Normal Power System Operation:
 1. Prerequisites: Acceptance of results for construction checklists for Division 26 electrical components associated with Normal power system.
 2. Equipment and Systems to Be Tested: Division 26 electrical equipment.
 3. Test Purpose: Verify operation of Normal power system.
 4. Test Conditions: Energize components of Normal power system, one at a time.
 5. Acceptance Criteria: Proper operation of Normal power system over a **24**-hour period.

B. Verification of Essential Power System Operation:

1. Prerequisites:
 - a. Acceptance of results for construction checklists for Division 26 electrical components associated with Essential power system.
 - b. Completion of "Verification of Normal Power System Operation" tests.
2. Equipment and Systems to Be Tested: Division 26 electrical equipment.
3. Test Purpose: Verify operation of Essential power system.
4. Test Conditions:
 - a. Energize components of Normal power system.
 - b. Simulate a failure of Normal power system.
5. Acceptance Criteria: Transfer of power from Normal to Essential power system within OPR.

C. Verification of Control and Instrumentation:

1. Prerequisites: Acceptance of results for construction checklists.
 - a. Section 26 09 13 "Electrical Power Monitoring and Control."
 - b. Section 26 09 26 "Lighting Control Panelboards."
 - c. Section 26 09 36 "Modular Dimming Controls."
 - d. Section 26 09 43.16 "Addressable-Luminaire Lighting Controls."
 - e. Section 26 09 43.23 "Relay-Based Lighting Controls."
 - f. Section 26 27 13 "Electricity Metering."
 - g. Section 26 35 33 "Power Factor Correction Equipment."

D. Test Purpose: Verify operation of control and monitoring systems for Normal and Essential power systems.

E. Test Conditions:

1. Energize components of Normal power system.
2. Test operation of equipment.

F. Acceptance Criteria: Operation of equipment according to OPR.

END OF SECTION

SECTION 26 09 23

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. Section Includes:
 - 1. Photoelectric switches.
 - 2. Indoor occupancy sensors.
 - 3. Wall stations
 - 4. Lighting contactors.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
 - 1. Interconnection diagrams showing field-installed wiring.
 - 2. Include diagrams for power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.01 ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant.

2.02 OUTDOOR PHOTOELECTRIC SWITCHES

- 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. [Cooper Industries, Inc.](#)
 2. [Intermatic, Inc.](#)
 3. [NSi Industries LLC; TORK Products.](#)
 4. [Tyco Electronics; ALR Brand.](#)
- B. Description: Solid state, with SPST dry contacts rated for 1800 VA, to operate connected load, complying with UL 773.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Light-Level Monitoring Range: **1.5 to 10 fc (16.14 to 108 lux)**, with an adjustment for turn-on and turn-off levels within that range.
 3. Time Delay: Thirty-second minimum, to prevent false operation.
 4. Lightning Arrester: Air-gap type.

2.03 INDOOR OCCUPANCY SENSORS

- 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. [Bryant Electric; a Hubbell company.](#)
 2. [Cooper Industries, Inc.](#)
 3. [Hubbell Building Automation, Inc.](#)
 4. [Leviton Mfg. Company Inc.](#)
 5. [Lithonia Lighting; Acuity Lighting Group, Inc.](#)
 6. [Lutron Electronics Co., Inc.](#)
 7. [Sensor Switch, Inc.](#)
 8. [Square D; a brand of Schneider Electric.](#)
- B. General Requirements for Sensors: Ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.

4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
 5. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a **1/2-inch (13-mm)** knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
 7. Bypass Switch: Override the "on" function in case of sensor failure.
 8. Automatic Light-Level Sensor: Adjustable from **2 to 200 fc (21.5 to 2152 lux)**; turn lights off when selected lighting level is present.
- C. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
1. Sensitivity Adjustment: Separate for each sensing technology.
 2. Detector Sensitivity: Detect occurrences of **6-inch- (150-mm-)** minimum movement of any portion of a human body that presents a target of not less than **36 sq. in. (232 sq. cm)**, and detect a person of average size and weight moving not less than **12 inches (305 mm)** in either a horizontal or a vertical manner at an approximate speed of **12 inches/s (305 mm/s)**.
 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of **1000 sq. ft. (93 sq. m)** when mounted on a **96-inch- (2440-mm-)** high ceiling.

2.04 Wall stations: Provide wall station lighting controls (symbols SE4 and SE2) as indicated on plans and lighting control details

2.05 LIGHTING CONTACTORS

- 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. [Allen-Bradley/Rockwell Automation.](#)
 2. [ASCO Power Technologies, LP; a division of Emerson Electric Co.](#)
 3. [Eaton Corporation.](#)
 4. [General Electric Company; GE Consumer & Industrial - Electrical Distribution; Total Lighting Control.](#)
 5. [Square D; a brand of Schneider Electric.](#)
- B. Description: Electrically operated and mechanically held, combination-type lighting contactors complying with NEMA ICS 2 and UL 508.
1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.

3. Enclosure: Comply with NEMA 250.
4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.
5. Where two-wire maintained switch control is indicated, provide solid-state control modules as required for indicated switching arrangement.

2.06 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 16 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.01 SENSOR INSTALLATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.02 WIRING INSTALLATION

- A. Wiring Method: Comply with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch (13 mm).
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.03 IDENTIFICATION

- A. Identify components and power and control wiring according to Section 26 05 53 "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.04 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Lighting control devices will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.05 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.

3.06 DEMONSTRATION

- A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control systems specified in Section 26 09 43 "Network Lighting Controls."
- B. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION

SECTION 26 12 19

PAD-MOUNTED, LIQUID-FILLED, MEDIUM-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Pad-mounted, liquid-filled, medium-voltage transformers.

B. Procurement coordination: Coordinate with the owner for identification of responsible party to procure this transformer. There are two concurrent projects the owner is working on; the same transformer configuration and rating will be utilized for each of the two projects; one for the other project and one for this project.

1. The two units may be procured together, directly by the owner. Installation of the unit assigned to this project would be by this project contractor.
2. The two units may be procured by the other project. Installation of the unit assigned to this project would be by this project contractor
3. Finally, a single unit could be procured by this project. Installation of the unit would be by this project contractor.

C. Related Requirements:

1. Section 01 81 16 "Facility Environmental Requirements" specifies basis-of-design environmental conditions and performance criteria that are applicable to product selection and installation of the Work on the Project.
2. Section 01 81 23 "Facility Seismic and Wind Criteria" specifies basis-of-design seismic and wind criteria for nonstructural components on the Project.
3. Section 26 00 10 "General Conditions for Electrical" specifies additional requirements applicable to coordinating, scheduling, and sequencing of the Work specified in this Section.
4. Section 26 05 13 "Medium-Voltage Cables" specifies installation of medium-voltage cables.
5. Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" specifies installation of low-voltage wiring.
6. Section 26 05 26 "Grounding and Bonding for Electrical Systems" specifies grounding and bonding referenced by this Section.
7. Section 26 05 29 "Hangers and Supports for Electrical Systems" specifies hangers, supports, and concrete bases referenced by this Section.
8. Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems" specifies vibration isolation and seismic control devices referenced by this Section.
9. Section 26 05 53 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs referenced by this Section.
10. Section 26 05 73 "Power System Studies" specifies arc-flash hazard analysis, warning labels, and circuit-breaker trip ranges referenced by this Section.

- D. Related Sections include the following:
 - 1. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 DEFINITIONS

- A. Bushing: An insulating structure including a central conductor, or providing a central passage for a conductor, with provision for mounting on a barrier, conducting or otherwise, for the purpose of insulating the conductor from the barrier and conducting current from one side of the barrier to the other.
- B. Bushing Elbow: An insulated device used to connect insulated conductors to separable insulated connectors on dead-front, pad-mounted transformers and to provide a fully insulated connection. This is also called an "elbow connector."
- C. Bushing Insert: That component of a separable insulated connector that is inserted into a bushing well to complete a dead-front, load break or no-load break, separable insulated connector (bushing).
- D. Bushing Well: A component of a separable insulated connector, either permanently welded or clamped to an enclosure wall or barrier, having a cavity that receives a replaceable component (bushing insert) to complete the separable insulated connector (bushing).
- E. Elbow Connector: See "bushing elbow" above.

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
- B. Preinstallation Coordination Meeting(s): For {Insert system or product}. Conduct meeting(s) at Project site before delivery.
 - 1. Attendees: Installers, fabricators, representatives of manufacturers, and administrators for field tests and inspections. Notify Architect, Construction Manager, and Owner's Commissioning Authority of scheduled meeting dates.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.
 - a. If listed manufacturer differs from selling manufacturer, indicate relationship between entities on submittal. Clearly indicate which entity warrants product performance and fitness for purpose.
 - b. Listing criteria identified in approval letter must match specified listing criteria. UL label indicating approval of equipment's enclosure is not considered approval of equipment for intended application.

- c. Product identification in approval letter must match product branding and model numbers in submittal. Approval letters for discontinued or superseded products are unacceptable for submitted product.
- 2. Product Certificates: Include product certificate stating compliance with IEEE C57.12.00, signed by manufacturer or fabricator.
- B. Factory test reports.
- C. Shop Drawings: Prepare and submit the following:
 - 1. Plans and elevations showing major components and features.
 - a. Plan view and cross section of equipment base, showing clearances, required workspace, and locations of penetrations for grounding and conduits.
 - 2. Details of equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of field connections.
 - 3. Single-line diagram.
 - 4. List of materials.
 - 5. Nameplate data.
 - 6. Manufacturer's published time-current curves of transformer line-side fuses, with transformer damage curve, inrush curve, and thru fault current indicated.
- D. Field quality-control reports.

1.05 INFORMATIONAL SUBMITTALS

- A. Manufacturer's published instructions.
- B. Manufacturer's field reports for field quality-control support.
- C. Field reports for voltage monitoring and adjusting.
- D. Field reports for infrared scanning.

1.06 QUALIFICATIONS

- A. Electrical Power Testing (EPT) Technician III: Possessing active NICET EPT Level III certification. Able to manage switching procedures, conduct tests of complex equipment, analyze test and equipment data, plan a job, and lead a team. Has experience performing NFPA 70B, IEEE, and NETA electrical tests.
- B. Electrical Power Testing (EPT) Technician IV: Possessing active NICET EPT Level IV certification. Able to conduct tests of complex metering and relay systems; evaluate tests, test equipment, test results, and power system performance; recommend actions to maintain or improve system performance; and lead multi-team projects.
- C. Electrical Power Testing and Inspecting Agency: Entities possessing active credentials from a qualified electrical testing laboratory recognized by authorities having jurisdiction.

1. On-site electrical testing supervisors must possess active NICET EPT Technician III certification.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Upon delivery of transformers and prior to unloading, inspect equipment for damage that may have occurred during shipment or storage.
2. Verify that tie rods and chains are undamaged and tight, and that blocking and bracing is tight. Verify that there is no evidence of load shifting in transit, and that readings from transportation shock recorders, if equipped, are within manufacturer's recommendations.
3. Verify that there is no indication of external damage and no dents or scratches in doors and sill, tank walls, radiators and fins, or termination provisions.
4. Verify that there is no evidence of insulating-liquid leakage on transformer surfaces, at weld seams, on line- or load-side bushing parts, and at transformer base.
5. Verify that there is positive pressure or vacuum on tank. Check pressure gauge; it is required to read other than zero.
6. Compare transformers and accessories received with bill of materials to verify that shipment is complete. Verify that transformers and accessories conform with manufacturer's quotation and shop drawings. If shipment is incomplete or does not comply with Project requirements, notify manufacturer in writing immediately.
7. Verify presence of polychlorinated biphenyl content labeling.
8. Unload transformers carefully, observing packing label warnings and handling instructions.
9. Open termination compartment doors and inspect components for damage or displaced parts, loose or broken connections, cracked or chipped insulators, bent mounting flanges, dirt or foreign material, and water or moisture.

B. Storage:

1. Store transformers in accordance with manufacturer's recommendations.
2. Transformers may be stored outdoors. If possible, store transformers at final installation locations on concrete pads. If dry concrete surfaces are unavailable, use pallets of adequate strength to protect transformers from direct contact with ground. Ensure that transformer is level.
3. Ensure that transformer storage location is clean and protected from severe conditions. Protect transformers from dirt, water, contamination, and physical damage. Do not store transformers in the presence of corrosive or explosive gases. Protect transformers from weather when stored for more than three months.
4. Store transformers with compartment doors closed.
5. Regularly inspect transformers while in storage and maintain documentation of storage conditions, noting discrepancies or adverse conditions. Verify that effective pressure seal is maintained using pressure gauges. Visually check for insulating-liquid leaks and rust spots.

C. Handling:

1. Handle transformers carefully, in accordance with manufacturer's recommendations, to avoid damage to enclosure, termination compartments, base, frame, tank, and internal components. Do not subject transformers to impact, jolting, jarring, or rough handling.
2. Protect transformer termination compartments against entrance of dust, rain, and snow.

3. Transport transformers upright, to avoid internal stresses on core and coil mounting assembly and to prevent trapping air in windings. Do not tilt or tip transformers.
4. Verify that transformer weights are within rated capacity of handling equipment.
5. Use only manufacturer-recommended points for lifting, jacking, and pulling. Use lifting lugs when lifting transformers.
6. Use jacks only at corners of tank base plate.
7. Use nylon straps of same length to balance and distribute weight when handling transformers with crane.
8. Use spreaders or lifting beam to obtain vertical lift and to protect transformer from straps bearing against enclosure. Lifting cable pull angles may not be greater than 15 degrees from vertical.
9. Exercise care not to damage tank base structure when handling transformer using skids or rollers. Use skids to distribute stresses over tank base when using rollers under large transformers.

1.08 SERVICE CONDITIONS FOR ELECTRICAL EQUIPMENT

- A. Modeling, analysis, product selection, installation, and quality control for all electrical Work on the Project must comply with service condition requirements specified in Section 01 81 16 "Facility Environmental Requirements" and Section 01 81 23 "Facility Seismic and Wind Criteria."
- B. Usual Service Conditions: Unless unusual service conditions have been specified in "General Environmental Conditions," "Outdoor Conditions," and "Indoor Conditions" articles of Section 01 81 16 "Facility Environmental Requirements," electrical service and distribution equipment must be suitable for operation under usual service conditions specified in applicable IEEE C57 series standards.

PART 2 - PRODUCTS

2.01 PERFORMANCE and PROCURMENT REQUIREMENTS

- A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by a qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
- B. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant

2.02 PAD-MOUNTED, LIQUID-FILLED, MEDIUM-VOLTAGE TRANSFORMERS

- A. Source Quality Control:
 1. Factory Tests:
 - a. Owner will witness required factory tests. Notify Architect at least 14 days before date of tests and indicate their approximate duration.
 - b. Factory Tests and Inspections: Perform the following tests and inspections on transformer, by, or under supervision of, qualified electrical testing laboratory recognized by authorities having jurisdiction, in accordance with IEEE C57.12.00

before delivering to site. Affix label with name and date of manufacturer's certification of system compliance.

- 1) Resistance.
- 2) Turns ratio, polarity, and phase relation.
- 3) Transformer no-load losses and excitation current at 100 percent of ratings.
- 4) Transformer impedance voltage and load loss.
- 5) Operation of devices.
- 6) Lightning impulse.
- 7) Low frequency.
- 8) Leak.
- 9) Perform Optional Tests:
 - a) Transformer no-load losses and excitation current at 110 percent of ratings.
 - b) Insulation power factor.
 - c) Applied potential, except that this test is not required for single-phase transformers or for three-phase Y-Y-connected transformers.
 - d) Induced potential.
 - e) Resistance measurements of windings on rated voltage connection and at tap extreme connections.
 - f) Ratios on rated voltage connection and at tap extreme connections.
 - g) Polarity and phase relation on rated voltage connection.
 - h) No-load loss at rated voltage on rated voltage connection.
 - i) Exciting current at rated voltage on rated voltage connection.
 - j) Impedance.

c. Nonconforming Work:

- 1) Equipment that does not pass tests and inspections will be considered defective.

d. Factory Test Reports: Compile and submit factory test and inspection reports.

B. Three-Phase, Pad-Mounted Transformers:

1. Provide one of the following manufactures
 - a. ABB Corp.
 - b. Schneider Electric
 - c. Eaton Cooper Power Corp.
 - d. Howard Industries
 - e. Maddox Transformers
2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:
 - a. Transformers, Distribution, Liquid-Filled Type, Over 600 V: UL CCN XPLH; including IEEE C57.12.00 and IEEE C57.12.28.
3. Standard Features:
 - a. Less-flammable-liquid-filled, two-winding, 60 Hz, 65 deg C rise above 30 deg C average ambient, self-cooled transformer.

- b. Reference Standards: IEEE C2 and IEEE C57.12.26.
- c. Windings Material: Aluminum.
- d. Surge Arresters: Comply with IEEE C62.11, Distribution Class; metal-oxide-varistor type, fully shielded, separable-elbow type, suitable for plugging into inserts provided in line-side section of transformer. Connected in each phase of incoming circuit and ahead of disconnecting device.
- e. Winding Connections: Connection of windings and terminal markings must comply with IEEE C57.12.70.
- f. Efficiency: Comply with 10 CFR 431, Subpart K.
- g. Insulation: Transformer kVA rating must be as follows: Average winding temperature rise above 30 deg C ambient temperature must not exceed 65 deg C and 80 deg C hottest-spot temperature rise at rated kVA when tested in accordance with IEEE C57.12.90, using combination of connections and taps that give highest average winding temperature rise.
- h. Tap Changer: External handle, for de-energized operation.
- i. Tank: Sealed, with welded-on cover. Designed to withstand internal pressure of not less than 7 psi without permanent distortion and 15 psig without rupture. Comply with IEEE C57.12.36.
- j. Enclosure Integrity: Comply with IEEE C57.12.28 for pad-mounted enclosures that contain energized electrical equipment in excess of 600 V that may be exposed to public.
- k. Mounting: Integral skid mounting frame, suitable to allow skidding or rolling of transformer in any direction, and with provision for anchoring frame to pad.
- l. Insulating Liquids:
 - 1) Less-Flammable Liquids:
 - a) Edible-Seed-Oil-Based Dielectric: Listed and labeled by qualified electrical testing laboratory recognized by authorities having jurisdiction as complying with NFPA 70 requirements for fire point of not less than 300 deg C when tested in accordance with ASTM D92. Liquid must be biodegradable and nontoxic, having passed Organization for Economic Co-operation and Development G.L.203 with zero mortality, and must be certified by U.S. Environmental Protection Agency as biodegradable, meeting Environmental Technology Verification requirements.
- m. Sound level must comply with NEMA TR 1 requirements.
- n. Corrosion Protection:
 - 1) Transformer coating system must be factory applied, complying with requirements of IEEE C57.12.28, in manufacturer's standard color green.
 - 2) Fabricate front sill, hood, and tank base of single-compartment transformers from stainless steel in accordance with ASTM A167, Type 304 or 304L, not less than No. 13 U.S. gage, complying with requirements of IEEE C57.12.28, standard color green.
 - 3) Base and Cabinets of Two Compartment Transformers: Fabricate from stainless steel in accordance with ASTM A167, Type 304 or 304L, not less than No. 13 U.S. gage. Coat transformer with manufacturer's standard green color coating complying with requirements of IEEE C57.12.28, in manufacturer's standard color green.

- o. Compartment Construction:
 - 1) Single-Compartment Construction: Clamshell style, with provision for padlocking, hinged cover, and single-point latching.
 - 2) Double-Compartment Construction: Individual compartments for line- and load-side sections, formed by steel isolating barriers that extend full height and depth of compartments, with hinged, lift-off doors and three-point latching, with stop in open position and provision for padlocking.
- p. Primary Fusing: Designed and rated to provide thermal protection of transformer by sensing overcurrent and high liquid temperature.
 - 1) 150 kV BIL current-limiting fuses, conforming to requirements of IEEE C37.42.
 - 2) Interrupting Rating: 50 000 A(rms sym) at system voltage.
 - 3) Fuse Assembly: Bayonet-type, liquid-immersed, expulsion fuses in series with liquid-immersed, partial-range, current-limiting fuses. Bayonet fuse must sense both high currents and high oil temperature to provide thermal protection to transformer. Connect current-limiting fuses ahead of radial-feed load-break switch.
 - 4) Provide bayonet fuse assembly with oil retention valve and external drip shield inside housing to eliminate or minimize oil spills. Valve must close when fuse holder is removed and external drip shield is installed.
 - 5) Provide conspicuously displayed warning adjacent to bayonet fuse(s), cautioning against removing or inserting fuses unless transformer has been de-energized and tank pressure has been released.
- q. Line-Side Section: Dead-front design.
 - 1) To connect primary cable, use separable insulated connectors; coordinated with and complying with requirements of Section 26 05 13 "Medium-Voltage Cables." Bushings must be one-piece units, with ampere and BIL ratings same as connectors.
 - 2) Bushing inserts and feed-through inserts:
 - a) Conform to requirements of IEEE 386.
 - b) Rated at 200 A, with voltage class matching connectors. Provide parking stand near bushing wells.
 - c) Provide insulated protective caps for insulating and sealing out moisture from unused bushing inserts and insulated standoff bushings.
 - 3) Bushing wells configured for loop-feed application.
 - 4) Access to liquid-immersed fuses.
 - 5) Dead-front surge arresters.
 - 6) Tap-changer operator.
 - 7) Ground pad.
- r. Load-Break Switch:
 - 1) Radial-feed, liquid-immersed type with voltage class and BIL matching that of separable connectors, with continuous current rating and load-break rating of 200 A, and make-and-latch rating of 12 kA(rms sym).

- s. Load-Side Section:
 - 1) Bushings with spade terminals drilled for terminating number of conductors indicated on the Drawings, and lugs that comply with requirements of Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
 - 2) Metering: Coordinated with and complying with requirements of Section 26 27 13 "Electricity Metering." Make provision for installation by providing mounting space, brackets, and cable and conduit routing as well as the following:
 - a) Sensors.
 - b) BAS interface.
 - c) Kilowatt-hour meter.
 - d) Kilowatt-hour demand meter.
 - t. Capacities and Characteristics:
 - 1) Power Rating: 300 kVA (KNAN).
 - 2) Voltage Ratings: 12.47 KV primary – 208/120 V secondary.
 - 3) Taps: Comply with IEEE C57.12.26 requirements.
 - 4) Transformer BIL (kV): Comply with IEEE C57.12.26 requirements; 95 kV (HV side), 30 kV (LV side).
 - 5) Minimum Tested Impedance (Percent) at 85 deg C: 5.75%.
 - 6) K-factor: 4.
 - 7) Comply with UL listing requirements for combination classification and listing for transformer and less-flammable insulating liquid.
 - u. Transformer Accessories:
 - 1) Drain and filter connection.
 - 2) Filling and top filter press connections.
 - 3) Pressure-vacuum gauge.
 - 4) Dial-type analog thermometer with alarm contacts.
 - 5) Magnetic liquid level indicator with high and low alarm contacts.
 - 6) Automatically resetting pressure-relief device. Device flow must be as recommended by manufacturer.
 - 7) Stainless steel ground connection pads.
 - 8) Machine-engraved nameplate, made of anodized aluminum or stainless steel.
 - 9) Sudden pressure relay for remote alarm or trip when internal transformer pressure rises at field-set rate. Provide with seal-in delay.
 - v. Control Network: Support serial MS/TP and Ethernet IP communications, and able to communicate directly via TIA-485 serial networks and Ethernet 10Base-T networks as native device.
4. Seismic and Wind Performance: Installed product must perform in accordance with Section 01 81 23 "Facility Seismic and Wind Criteria" and the following:

- a. Withstand Requirement: Unit must remain in place without separation of parts when subjected to specified criteria during seismic events and unit must be fully operational after seismic events.
- b. Component Importance Factor (I_p): 1.0.
- c. Component Amplification Factor (a_p): 1.0.
- d. Component Response Modification Factor (R_p): 2.5.
- e. Component Overstrength Factor (Ω_o): 2.5.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and space conditions for compliance with requirements for pad-mounted, liquid-filled, medium-voltage transformers and other conditions affecting performance of the Work.
- B. Examine roughing-in of conduits and grounding systems to verify the following:
 - 1. Wiring entries comply with layout requirements.
 - 2. Entries are within conduit-entry tolerances specified by manufacturer, and no feeders will cross section barriers to reach load or line lugs.
- C. Examine concrete bases for suitable conditions for transformer installation.
- D. Preinstallation Checks:
 - 1. Verify removal of shipping bracing after placement.
 - 2. Remove sample of insulating liquid in accordance with ASTM D923. Insulating-liquid values must comply with NETA ATS, Table 100.4. Sample must be tested for the following:
 - a. Dielectric Breakdown Voltage: ASTM D877 or ASTM D1816.
 - b. Acid Neutralization Number: ASTM D974.
 - c. Specific Gravity: ASTM D1298.
 - d. Interfacial Tension: ASTM D971.
 - e. Color: ASTM D1500.
 - f. Visual Condition: ASTM D1524.
 - g. Water in Insulating Liquids: Comply with ASTM D1533.
 - h. Power Factor or Dissipation Factor: ASTM D924.
- E. Verify that grounding and bonding connections are in place. Ground (Earth) resistance may not exceed 5 Ω at transformer location.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Comply with manufacturer's published instructions.
- B. Reference Standards for Installation: Unless more stringent installation requirements are specified in the Contract Documents or manufacturer's published instructions, comply with the following:

1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.
2. Electrical Maintenance: NFPA 70B.
3. Electrical Safety: NFPA 70E.
4. Commissioning of Electrical Systems: NECA NEIS 90.
5. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
6. Communications Work: BICSI N1.
7. Emergency and Standby Power Work: NFPA 110, NFPA 111, and NECA NEIS 416.
8. Work in Confined Spaces: NFPA 350.
9. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
10. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:

1. Install transformers on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 26 05 29 "Hangers and Supports for Electrical Systems."
2. Transformer must be installed level and plumb and must tilt less than 1.5 degrees while energized.
3. Maintain minimum clearances and workspace at equipment in accordance with manufacturer's published instructions and IEEE C2.

D. Grounding and Bonding:

1. For counterpoise, use tinned bare copper cable not smaller than 4/0 AWG, buried not less than 30 inch below grade interconnecting grounding electrodes. Bond surge arrester and neutrals directly to transformer enclosure and then to grounding electrode system with bare copper conductors, sized as shown. Keep lead lengths as short as practicable, with no kinks or sharp bends.
2. Fence and equipment connections may not be smaller than 4 AWG. Ground fence at gate posts and corner posts and at intervals not exceeding 10 ft. Bond gate sections to fence posts using 1/8 by 1 inch tinned flexible braided copper strap and clamps.
3. Make joints in grounding conductors and loops by exothermic weld or compression connector.
4. Terminate grounding and bonding conductors on common equipment grounding terminal on transformer enclosure.
5. Complete transformer tank grounding and lightning arrester connections prior to making other electrical connections.

E. Connect low-voltage wiring.

1. Maintain air clearances between energized live parts and between live parts and ground for exposed connections in accordance with manufacturer recommendations.
2. Bundle associated phase, neutral, and equipment grounding conductors together within transformer enclosure. Arrange conductors such that there is not excessive strain that could cause loose connections. Allow adequate slack for expansion and contraction of conductors.

F. Terminate medium-voltage cables in incoming section of transformers.

G. Interfaces with Other Work:

1. Identification: Provide labels for transformers and associated electrical equipment.
 - a. Identify field-installed conductors, interconnecting wiring, and components.
 - b. Label each enclosure with engraved metal or laminated-plastic nameplate.

- c. Provide warning signs and arc-flash hazard warning labels for electrical equipment.
2. Install transformers on cast-in-place concrete equipment base(s).
3. Provide vibration isolation and seismic control devices.

3.03 FIELD QUALITY CONTROL

- A. Administrant for Electrical Power Tests and Inspections:
 1. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
- B. Field tests and inspections must be witnessed by Tenant.
- C. Tests and Inspections:
 1. General Field-Testing Requirements:
 - a. Comply with provisions of "Testing and Test Methods" Chapter in NFPA 70B.
 - b. Perform visual and mechanical inspections and electrical tests. Certify compliance with test parameters.
 - c. After installing transformer but before primary is energized, verify that grounding system at transformer is tested at specified value or less.
 - d. After installing transformer and after electrical circuitry has been energized, test for compliance with requirements.
 - e. Visual and Mechanical Inspection:
 - 1) Verify equipment nameplate data complies with the Contract Documents.
 - 2) Inspect bolted electrical connections for high resistance using one of the following two methods:
 - a) Use low-resistance ohmmeter to compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of lowest value.
 - b) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS, Table 100.12. Bolt-torque levels must be in accordance with manufacturer's published data. In absence of manufacturer's published data, use NETA ATS, Table 100.12.
 2. Medium-Voltage Surge Arrester Field Tests:
 - a. Visual and Mechanical Inspection:
 - 1) Inspect physical and mechanical condition.
 - 2) Verify arresters are clean.
 - 3) Verify that ground leads on devices are individually attached to ground bus or ground electrode.

- b. Electrical Test:
 - 1) Perform insulation-resistance test on arresters, phase terminal-to-ground. Apply voltage in accordance with manufacturer's published data. In absence of manufacturer's published data, comply with NETA ATS, Table 100.1. Replace units that fail to comply with recommended minimum insulation resistance listed in that table.
 - 2) Perform watts-loss test. Evaluate watts-loss values by comparison with similar units and test equipment manufacturer's published data.
- 3. Liquid-Filled Transformer Field Tests:
 - a. Visual and Mechanical Inspection:
 - 1) Test dew point of tank gases if applicable.
 - 2) Inspect anchorage, alignment, and grounding.
 - 3) Verify bushings are clean.
 - 4) Verify that alarm, control, and trip settings on temperature and level indicators are set and operate within manufacturer's recommended settings.
 - 5) Verify that liquid level in tanks is within manufacturer's published tolerances.
 - 6) Perform specific inspections and mechanical tests recommended by manufacturer.
 - 7) Verify presence of transformer surge arresters and that their ratings are as specified.
 - 8) Verify that as-left tap connections are as specified.
 - b. Electrical Tests:
 - 1) Perform insulation-resistance tests winding-to-winding and windings-to-ground. Apply voltage in accordance with manufacturer's published data. In absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index; value of index may not be less than 1.0.
 - 2) Perform power-factor or dissipation-factor tests on windings in accordance with test equipment manufacturer's published data. Maximum winding insulation power-factor/dissipation-factor values must be in accordance with manufacturer's published data. In absence of manufacturer's published data, comply with NETA ATS, Table 100.3.
 - 3) Measure core insulation resistance at 500 V(dc) if core is insulated and core ground strap is removable. Core insulation-resistance values may not be less than 1 MΩ at 500 V(dc).
 - 4) Perform Optional Field Tests:
 - a) Perform turns-ratio tests at tap positions. Turns-ratio test results may not deviate by more than one-half percent from either adjacent coils or calculated ratio. If test fails, replace transformer.
 - b) Perform excitation-current test on each phase. Typical excitation-current test data pattern for three-legged core transformer is two similar current readings and one lower current reading. Investigate and correct if test shows different pattern.
 - c) Measure resistance of windings at tap connections, and record temperature-corrected winding-resistance values in Operations and Maintenance Manual.
 - d) Perform applied-voltage test on line- and load-side windings-to-ground. Comply with IEEE C57.12.91, Sections 10.2 and 10.9. This

test is not required for single-phase transformers and for three-phase wye-wye-connected transformers.

- 5) Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.
- 6) Remove sample of insulating liquid in accordance with ASTM D923, and perform dissolved-gas analysis in accordance with IEEE C57.104 or ASTM D3612.

D. Nonconforming Work:

1. Equipment and devices will be considered defective if they do not pass tests and inspections.
2. Remove and replace malfunctioning units and retest.

E. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports. Record as-left set points of adjustable devices.

F. Manufacturer Services: Engage factory-authorized service representative to support field tests and inspections.

1. Manufacturer's Field Reports for Field Quality-Control Support: Prepare and submit report after each visit by factory-authorized service representative, documenting activities performed at the Project site.

3.04 CLOSEOUT ACTIVITIES

A. Training:

1. With assistance from factory-authorized service representatives, train Owner's maintenance personnel on the following topics:
 - a. How to adjust, operate, and maintain transformer equipment.
2. Allow Owner to record training sessions.

3.05 PROTECTION

- A. After installation, protect transformer from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

3.06 MAINTENANCE

- A. Voltage Monitoring and Adjusting: After Substantial Completion, if requested by Owner, but not more than six months after Final Acceptance, perform the following voltage monitoring:
1. During period of normal load cycles as evaluated by Owner, perform seven days of three-phase voltage recording at outgoing section of transformers. Use voltmeters with calibration traceable to National Institute of Science and Technology standards and with chart speed of not less than 1 inch per hour. Voltage unbalance greater than 1 percent

- between phases, or deviation of phase voltage from nominal value by more than plus or minus 5 percent during test period, is unacceptable.
2. Corrective Action: If test results are unacceptable, perform the following corrective action, as appropriate:
 - a. Adjust transformer taps.
 - b. Prepare written request for voltage adjustment by electric utility.
 3. Retests: Repeat monitoring, after corrective action is performed, until satisfactory results are obtained.
 4. Field Reports for Voltage Monitoring and Adjusting: Prepare written report covering monitoring performed and corrective action taken.
- B. Infrared Scanning of Transformers: Perform survey during periods of maximum possible loading. Remove necessary covers prior to inspection.
1. After Substantial Completion, but not more than 60 days after Final Acceptance, perform infrared inspection of transformer's electrical power connections. Remove covers so joints and connections are accessible to portable scanner. Take visible light photographs at same locations and orientations as infrared scans for documentation to ensure follow-on scans match same conditions for valid comparison.
 2. Instrument: Inspect distribution systems with imaging equipment capable of detecting minimum temperature difference of 1 deg C at 30 deg C. Provide documentation of device calibration.
 3. Field Reports for Infrared Scanning: Prepare certified report that identifies transformer equipment checked, testing technician, and equipment used, and that describes scanning results. Include notation of deficiencies detected, remedial actions taken, and scanning observations after remedial action. List results as follows:
 - a. Description of equipment to be tested.
 - b. Discrepancies.
 - c. Temperature difference between area of concern and reference area.
 - d. Probable cause of temperature difference.
 - e. Areas inspected. Identify inaccessible and unobservable areas and equipment.
 - f. Identify load conditions at time of inspection.
 - g. Provide photographs and thermograms of deficient area.
 4. Act on inspection results in accordance with recommendations of NETA ATS, Table 100.18. Correct possible and probable deficiencies as soon as Owner's operations permit. Retest until deficiencies are corrected.

END OF SECTION

SECTION 26 24 13

SWITCHBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. Section Includes:
 - 1. Service and distribution switchboards rated 600 V and less.
 - 2. Surge protection devices.
 - 3. Disconnecting and overcurrent protective devices.
 - 4. Instrumentation.
 - 5. Control power.
 - 6. Accessory components and features.
 - 7. Identification.
- B. Related Requirements
 - 1. Section 26 05 74 "Overcurrent Protective Device Arc-Flash Study" for arc-flash analysis and arc-flash label requirements.
 - 2. Section 26 05 73 "Overcurrent Protective Device Coordination Study" for arc-flash analysis and arc-flash label requirements.
 - 3. Section 26 05 72 "Overcurrent Protective Device Short-Circuit Study" for arc-flash analysis and arc-flash label requirements.
 - 4. Appendix: DOC Standard Terms and Conditions (BABAA)

1.03 ACTION SUBMITTALS

- A. Product Data: For each switchboard, overcurrent protective device, surge protection device, ground-fault protector, accessory, and component.
 - 1. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
- B. Shop Drawings: For each switchboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.

2. Detail enclosure types for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
6. Detail utility company's metering provisions with indication of approval by utility company.
7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
8. Include schematic and wiring diagrams for power, signal, and control wiring.

C. Delegated Design Submittal:

1. For arc-flash hazard, short-circuit and coordination analysis and report.
2. For arc-flash labels.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Data: Certificates, for switchboards, overcurrent protective devices, 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. 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.

C. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
 - a. Routine maintenance requirements for switchboards and all installed components.
 - b. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - c. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device.

1.06 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. Potential Transformer Fuses: Equal to 10 percent of quantity installed for each size and type but no fewer than two of each size and type.
 - 2. Control-Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
 - 3. Fuses and Fusible Devices for Fused Circuit Breakers: Equal to 10 percent of quantity installed for each size and type but no fewer than three of each size and type.
 - 4. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type but no fewer than three of each size and type.
 - 5. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type but no fewer than three of each size and type.
 - 6. Indicating Lights: Equal to 10 percent of quantity installed for each size and type but no less than one of each size and type.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.
- B. Testing Agency Qualifications: Accredited by NETA.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.
- B. Remove loose packing and flammable materials from inside switchboards and install temporary electric heating (250 W per section) to prevent condensation.
- C. Handle and prepare switchboards for installation according to NECA 400.

1.09 FIELD CONDITIONS

- A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.
- B. Environmental Limitations:
 - 1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

- a. Ambient Temperature: Not exceeding 104 deg F.
 - b. Altitude: Not exceeding 6600 feet.
- C. Unusual Service Conditions: NEMA PB 2, as follows:
 - 1. Ambient temperatures within limits specified.
 - 2. Altitude not exceeding 6600 feet.
- D. Interruption of Existing Electric Service: Do not interrupt electric service to the immediate facility and campus facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Construction Manager and Owner no fewer than seven days in advance of proposed interruption of electric service.
 - 2. Indicate method of providing temporary electric service.
 - 3. Do not proceed with interruption of electric service without Construction Manager's and Owner's written permission.
 - 4. Comply with NFPA 70E.

1.10 COORDINATION

- A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.11 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace switchboard enclosures, buswork, overcurrent protective devices, accessories, and factory installed interconnection wiring that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Three years from date of Substantial Completion.
- B. Manufacturer's Warranty: Manufacturer's agrees to repair or replace surge protection devices that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit
 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution
 3. Siemens Energy & Automation, Inc
 4. Square D; a brand of Schneider Electric
- B. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant.

2.02 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Switchboards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation. Shake-table testing shall comply with ICC-ES AC156.
 2. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.03 SWITCHBOARDS

- A. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- 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. Comply with NEMA PB 2.
- E. Comply with NFPA 70.
- F. Comply with UL 891.
- G. Front-Connected, Front-Accessible Switchboards:
1. Main Devices: Fixed, individually mounted.
 2. Branch Devices: Panel mounted.
 3. Sections front and rear aligned.
- H. Nominal System Voltage: 120/208 V., three phase, four wire (wye)
- I. Main-Bus Continuous: 1200 A.
- J. AIC ratings shall align with the results of the fault study.

- K. Arc Flash labels shall be applied in accordance with arc flash study.
- L. Seismic Requirements: Fabricate and test switchboards according to IEEE 344 to withstand seismic forces defined in Section 26 05 48.16 "Seismic Controls for Electrical Systems."
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation. Shake-table testing shall comply with ICC-ES AC156.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
- M. Indoor Enclosures: Steel, NEMA 250, Type 1.
- N. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.
- O. Barriers: Between adjacent switchboard sections.
- P. Insulation and isolation for main bus of main section and main and vertical buses of feeder sections. In the emergency switchboard isolate the life safety distribution circuit breaker section from the stand-by distribution breaker sections.
- Q. Service Entrance Rating: Switchboards intended for use as service entrance equipment shall contain from one to six service disconnecting means with overcurrent protection, a neutral bus with disconnecting link, a grounding electrode conductor terminal, and a main bonding jumper.
- R. Customer Metering Compartment: A separate customer metering compartment and section with front hinged door, and section with front hinged door, for indicated metering, and current transformers for each meter. Current transformer secondary wiring shall be terminated on shorting-type terminal blocks. Include potential transformers having primary and secondary fuses with disconnecting means and secondary wiring terminated on terminal blocks.
- S. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.
- T. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.
- U. Pull Box on Top of Switchboard:
 - 1. Adequate ventilation to maintain temperature in pull box within same limits as switchboard.
 - 2. Removable covers shall form top, front, and sides. Top covers at rear shall be easily removable for drilling and cutting.
 - 3. Bottom shall be insulating, fire-resistive material with separate holes for cable drops into switchboard.
 - 4. Cable supports shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.
- V. Buses and Connections: Three phase, four wire unless otherwise indicated.

1. Provide phase bus arrangement A, B, C from front to back, top to bottom, and left to right when viewed from the front of the switchboard.
 2. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity.
 3. Copper feeder circuit-breaker line connections.
 4. Ground Bus: Minimum-size required by UL 891, hard-drawn copper of 98 percent conductivity, equipped with compression connectors for feeder and branch-circuit ground conductors.
 5. Main-Phase Buses and Equipment-Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
 6. Disconnect Links:
 - a. Isolate neutral bus from incoming neutral conductors.
 - b. Bond neutral bus to equipment-ground bus for switchboards utilized as service equipment or separately derived systems.
 7. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with compression connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
 8. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.
- W. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.
- X. Bus-Bar Insulation: Factory-applied, flame-retardant, tape wrapping of individual bus bars or flame-retardant, spray-applied insulation. Minimum insulation temperature rating of 105 deg C.
- Y. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components including instruments and instrument transformers.

2.04 SURGE PROTECTION DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton.
 2. General Electric Company.
 3. Siemens
 4. Schneider Electric (Square D)
- B. SPDs: Comply with UL 1449, Type 1.
- C. Features and Accessories:
1. Integral disconnect switch.
 2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
 3. Indicator light display for protection status.

4. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 5. Surge counter.
- D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 250kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
- E. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, three-phase, four-wire circuits shall not exceed the following:
1. Line to Neutral: 1200 V for 480Y/277 V.
 2. Line to Ground: 1200 V for 480Y/277 V.
 3. Line to Line: 2000 V for 480Y/277 V.
- F. SCCR: Equal or exceed 200 kA.
- G. Nominal Rating: 20 kA.

2.05 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB) for distribution breakers: Comply with UL 489, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long and short time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.
 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
 6. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
 7. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
 8. MCCB Features and Accessories:

- a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - e. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system specified in Section 26 09 13 "Electrical Power Monitoring and Control."
 - f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 - g. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 - h. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
- B. Insulated-Case Circuit Breaker (ICCB) for main breaker: 100 percent rated, sealed, insulated-case power circuit breaker with interrupting capacity rating to meet available fault current.
- 1. Fixed circuit-breaker mounting.
 - 2. Two-step, stored-energy closing.
 - 3. Standard-function, microprocessor-based trip units with interchangeable rating plug, trip indicators, and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Time adjustments for long- and short-time pickup.
 - c. Ground-fault pickup level, time delay, and I^2t response.
 - 4. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
 - 5. Remote trip indication and control.
 - 6. Communication Capability: Web enabled integral Ethernet communication module and embedded Web server with factory-configured Web pages (HTML file format). Provide functions and features compatible with power monitoring and control system specified in Section 26 09 13 "Electrical Power Monitoring and Control."
 - 7. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
 - 8. Control Voltage: 120-V ac.

2.06 INSTRUMENTATION

- A. Instrument Transformers: NEMA EI 21.1, and the following:
- 1. Potential Transformers: NEMA EI 21.1; 120 V, 60 Hz, single secondary; disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.
 - 2. Current Transformers: NEMA EI 21.1; 5 A, 60 Hz, secondary; wound type; single secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.

3. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kVA.
 4. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.
- B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:
1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:
 - a. Phase Currents, Each Phase: Plus or minus 0.5 percent.
 - b. Phase-to-Phase Voltages, Three Phase: Plus or minus 0.5 percent.
 - c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 0.5 percent.
 - d. Megawatts: Plus or minus 1 percent.
 - e. Megavars: Plus or minus 1 percent.
 - f. Power Factor: Plus or minus 1 percent.
 - g. Frequency: Plus or minus 0.1 percent.
 - h. Accumulated Energy, Megawatt Hours: Plus or minus 1 percent; accumulated values unaffected by power outages up to 72 hours.
 - i. Megawatt Demand: Plus or minus 1 percent; demand interval programmable from five to 60 minutes.
 - j. Contact devices to operate remote impulse-totalizing demand meter.
 2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.
 3. Ratchets to prevent reverse rotation.
 4. Removable meter with drawout test plug.
 5. Semiflush mounted case with matching cover.
 6. Appropriate multiplier tag.

2.07 CONTROL POWER

- A. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from control-power transformer.

2.08 ACCESSORY COMPONENTS AND FEATURES

- A. Portable Test Set: For testing functions of solid-state trip devices without removing from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.
- B. Spare-Fuse Cabinet: Suitably identified, wall-mounted, lockable, compartmented steel box or cabinet. Arrange for wall mounting.

- C. Mounting Accessories: For anchors, mounting channels, bolts, washers, and other mounting accessories, comply with requirements in Section 26 05 48.16 "Seismic Controls for Electrical Systems" or manufacturer's instructions.

2.09 IDENTIFICATION

- A. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Receive, inspect, handle, and store switchboards according to NECA 400.
 - 1. Lift or move panelboards with spreader bars and manufacturer-supplied lifting straps following manufacturer's instructions.
 - 2. Use rollers, slings, or other manufacturer-approved methods if lifting straps are not furnished.
 - 3. Protect from moisture, dust, dirt, and debris during storage and installation.
 - 4. Install temporary heating during storage per manufacturer's instructions.
- B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.
- C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work or that affect the performance of the equipment.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install switchboards and accessories according to NECA 400.
- B. Equipment Mounting: Install switchboards on concrete base, 4-inch nominal thickness. Comply with requirements for concrete base specified in Section 03 30 00 "Cast-in-Place Concrete."
 - 1. Install conduits entering underneath the switchboard, entering under the vertical section where the conductors will terminate. Install with couplings flush with the concrete base. Extend 2 inches above concrete base after switchboard is anchored in place.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 - 3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to switchboards.
 - 6. Anchor switchboard to building structure at the top of the switchboard if required or recommended by the manufacturer.

- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, straps and brackets, and temporary blocking of moving parts from switchboard units and components.
- D. Comply with mounting and anchoring requirements specified in Section 26 05 48.16 "Seismic Controls for Electrical Systems."
- E. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.
- F. Install filler plates in unused spaces of panel-mounted sections.
- G. Install overcurrent protective devices, surge protection devices, and instrumentation.
 - 1. Set field-adjustable switches and circuit-breaker trip ranges.
- H. Install spare-fuse cabinet.
- I. Comply with NECA 1.

3.03 CONNECTIONS

- A. Bond conduits entering underneath the switchboard to the equipment ground bus with a bonding conductor sized per NFPA 70.
- B. Support and secure conductors within the switchboard according to NFPA 70.
- C. Extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.

3.04 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
- B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
- C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.05 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

- C. Perform tests and inspections with the assistance of a factory-authorized service representative.
- D. Tests and Inspections:
 - 1. Acceptance Testing:
 - a. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit. Open control and metering circuits within the switchboard, and remove neutral connection to surge protection and other electronic devices prior to insulation test. Reconnect after test.
 - b. Test continuity of each circuit.
 - 2. Test ground-fault protection of equipment for service equipment per NFPA 70.
 - 3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 4. Correct malfunctioning units on-site where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 5. Perform the following infrared scan tests and inspections, and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchboard. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.
 - c. Instruments and Equipment:
 - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 6. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Switchboard will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.06 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 26 05 73.16 "Coordination Studies."

3.07 PROTECTION

- A. Temporary Heating: Apply temporary heat, to maintain temperature according to manufacturer's written instructions, until switchboard is ready to be energized and placed into service.

3.08 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories, and to use and reprogram microprocessor-based trip, monitoring, and communication units.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. Section Includes:
 - 1. Straight-blade convenience, receptacles.
 - 2. GFCI receptacles and/or circuit breakers
 - 3. AFCI receptacles and/or circuit breakers
 - 4. Controlled receptacles (per IECC)
 - 5. Specification-grade straight-blade receptacles
 - 6. Tamper-resistant receptacles
 - 7. Twist-locking receptacles.
 - 8. Cord and plug sets.
 - 9. Toggle switches.
 - 10. Wall switch sensor light switches with dual technology sensors.
 - 11. Wall plates.

1.03 DEFINITIONS

- A. Abbreviations of Manufacturers' Names:
 - 1. Cooper: Cooper Wiring Devices; Division of Cooper Industries, Inc.
 - 2. Hubbell: Hubbell Incorporated: Wiring Devices-Kellems.
 - 3. Leviton: Leviton Mfg. Company, Inc.
 - 4. Pass & Seymour: Pass& Seymour/Legrand.
- B. EMI: Electromagnetic interference.
- C. GFCI: Ground-fault circuit interrupter.
- D. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.04 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.

1.05 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.06 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

2.01 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Comply with NFPA 70.
- C. RoHS compliant.
- D. Comply with NEMA WD 1.
- E. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
 - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 - 2. Devices shall comply with requirements in this Section.
- F. Devices for Owner-Furnished Equipment:
 - 1. Receptacles: Match plug and NEMA configurations.
 - 2. Cord and Plug Sets: Match equipment requirements.
- G. Device Color:
 - 1. Wiring Devices Connected to Normal Power System: **As selected by Architect** unless otherwise indicated or required by NFPA 70 or device listing.
 - 2. Wiring Devices Connected to Essential Electrical System: **Red**.
 - 3. UPS Devices: Blue.

- H. Wall Plate Color: For plastic covers, match device color.
- I. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.
- J. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant

2.02 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

A. Duplex Receptacles, 125 V, 20 A:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
 - a. Eaton (Arrow Hart) - 5361 (single); 5362 (duplex).
 - b. Hubbell Incorporated; Wiring Device-Kellems - HBL5361 (single); HBL5362 (duplex).
 - c. Leviton Manufacturing Co., Inc. - 5361 (single); 5362 (duplex).
 - d. Pass & Seymour/Legrand - 5361 (single); 5362 (duplex).
- 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. Isolated-Ground Duplex Receptacles, 125 V, 20 A:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
 - a. Eaton (Arrow Hart) - IG5362RN.
 - b. Hubbell Incorporated; Wiring Device-Kellems - IG5362.
 - c. Leviton Manufacturing Co., Inc. - 5362-IG.
 - d. Pass & Seymour/Legrand - IG5362.
- 2. Description: Straight blade; equipment grounding contacts shall be connected only to green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts. 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.

C. Tamper-Resistant Duplex Receptacles, 125 V, 20 A:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
 - a. Eaton (Arrow Hart) - TRBR20.
 - b. Hubbell Incorporated; Wiring Device-Kellems - BR20TR.
 - c. Leviton manufacturing Co., Inc. - TBR20TR.
 - d. Pass & Seymour/Legrand - TR20.
- 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.

D. Weather-Resistant Duplex Receptacle, 125 V, 20 A:

1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
 - a. Eaton (Arrow Hart) - WRBR20.
 - b. Hubbell Incorporated; Wiring Device-Kellems - 5362WR.
 - c. Leviton Manufacturing Co., Inc. - WBR20.
 - d. Pass & Seymour/Legrand - WR20.
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.

E. Tamper- and Weather-Resistant Duplex Receptacles, 125 V, 20 A:

1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
 - a. Eaton (Arrow Hart) - TWRBR20.
 - b. Hubbell Incorporated; Wiring Device-Kellems - BR20WRTR.
 - c. Leviton Manufacturing Co., Inc. - TWR20.
 - d. Pass & Seymour/Legrand - WR20TR.
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, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.03 USB RECEPTACLES

A. Tamper-Resistant Duplex and USB Charging Receptacles:

1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
 - a. Eaton (Arrow Hart) - TRUSBAC20.
 - b. Hubbell Incorporated; Wiring Device-Kellems - USB20AC5.
 - c. Leviton Manufacturing Co., Inc. - T5833.
 - d. Pass & Seymour/Legrand - TR20USBAC6.

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, (1) USB Type A, (1) USB Type C, 5 V dc, and 5 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.

2.04 GFCI RECEPTACLES, 125 V, 20 A

A. Duplex GFCI Receptacles, 125 V, 20 A, Self-Testing:

1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
 - a. Eaton (Arrow Hart) - SGF20.
 - b. Hubbell Incorporated; Wiring Device-Kellems – GFR20.
 - c. Leviton Manufacturing Co, Inc. - GFTR2.
 - d. Pass & Seymour/Legrand - 2097.
2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two-pole, three-wire, and self-grounding.
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.

B. Tamper-Resistant Duplex GFCI Receptacles, 125 V, 20 A, Self-Testing:

1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
 - a. Eaton (Arrow Hart) - TRSGF20.
 - b. Hubbell Incorporated; Wiring Device-Kellems - GFTRST20.
 - c. Leviton Manufacturing Co., Inc. - TRSGF20.
 - d. Pass & Seymour/Legrand - 2097TR.
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.

C. Tamper- and Weather-Resistant, GFCI Duplex Receptacles, 125 V, 20 A, Self-Testing:

1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

- a. [Eaton \(Arrow Hart\) - WRS GF20.](#)
 - b. [Hubbell Incorporated; Wiring Device-Kellems - GFTWRST20.](#)
 - c. [Leviton Manufacturing Co., Inc. - GFWT2.](#)
 - d. [Pass & Seymour/Legrand - 2097TRWR.](#)
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 5-20.
 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.

2.05 AF RECEPTACLES, 125 V, 20 A

- A. Duplex AF Receptacles, 125 V, 20 A, Tamper-Resistant Duplex Straight-Blade Receptacle with AFCI Device:
 1. [Basis-of-Design Product:](#) Subject to compliance with requirements, provide comparable product by one of the following:
 - a. Eaton (Arrow Hart) - TRAFCI20A.
 - b. Hubbell Incorporated; Wiring Device-Kellems - AF20TRW.
 - c. Leviton Manufacturing Co, Inc. - AGTR2.
 - d. Pass & Seymour/Legrand - AF202TR.
 2. Description: Integral AFCI with "Test" and "Reset" buttons and LED indicator light. Two-pole, three-wire, and self-grounding.
 3. Configuration: NEMA WD 6, Configuration 5-20R.
 4. Type: Feed through.

2.06 DUAL-FUNCTION AF/GF RECEPTACLES, 125 V, 20 A

- A. Duplex AF/GF Receptacles, 125 V, 20 A, Tamper-Resistant Duplex Straight-Blade Receptacle with AFCI and GFCI Device:
 1. [Basis-of-Design Product:](#) Subject to compliance with requirements, provide comparable product by one of the following:
 - a. Eaton (Arrow Hart) - TRAFGF20A.
 - b. Hubbell Incorporated; Wiring Device-Kellems - AF20TRW.
 - c. Leviton Manufacturing Co, Inc. - AGTR2.
 - d. Pass & Seymour/Legrand - AFGF202TR.
 2. Description: Integral AFCI with "Test" and "Reset" buttons and LED indicator light. Two-pole, three-wire, and self-grounding.
 3. Configuration: NEMA WD 6, Configuration 5-20R.
 4. Type: Feed through.
- B. Outlet Branch-Circuit Type AFCIs and GFCIs: UL CCN KCXX, UL 498, UL943, UL 1699, and UL Subject 1699A.

2.07 CONTROLLED RECEPTACLES

- A. Single, Duplex Receptacles with Controlled Receptacle Marking, 125V, 20A: Comply with NEMA WD 1. NEMA WD 6 configuration 5-20R, UL 498 and FS W-C-596.
1. Basis-of-Design Project: Subject to compliance with requirements, provide comparable product by one of the following:
 - a. Eaton (Arrow Hart) – 5362CH (split-controlled); 5362CD (dual-controlled).
 - b. Hubbell Incorporated; Wiring Device-Kellems - BR20C1 (split-controlled); BR20C2 (dual-controlled)
 - c. Leviton Manufacturing Co., Inc. - M5363-1C (split-controlled); M5362-2S (dual-controlled).
 - d. Pass & Seymour/Legrand - 5362CH (split-controlled); 5362CD (dual-controlled).
 2. Description:
 - a. Duplexed receptacle with engraved NEMA approved controlled receptacle marking and engraved label stating "controlled" receptacle.
 - b. Marked outlet to be controlled by automatic means which removes power from the outlet.
 3. Markings:
 - a. Listed and labeled as complying with NFPA 70, "Controlled Receptacles" Article.
- B. Single, Tamper-Resistant Duplex Receptacles with Controlled Receptacle Marking, 125V, 20A: Comply with NEMA WD 1. NEMA WD 6 configuration 5-20R, UL 498 and FS W-C-596.
1. Basis-of-Design Project: Subject to compliance with requirements, provide comparable product by one of the following:
 - a. Eaton (Arrow Hart) - TR5362CH (split-controlled); TR5362CD (dual-controlled).
 - b. Hubbell Incorporated; Wiring Device-Kellems - BR20C1TR (split-controlled); BR20C2TR (dual-controlled)
 - c. Leviton Manufacturing Co., Inc. - MT563-1C (split-controlled); MT563-2S (dual-controlled).
 - d. Pass & Seymour/Legrand - TR5362CH (split-controlled); TR5362CD (dual-controlled).
 2. Description:
 - a. Tamper-resistant duplexed receptacle with engraved NEMA approved controlled receptacle marking and engraved label stating "controlled" receptacle.
 - b. Integral shutters that operate only when a plug is inserted in the receptacle.
 - c. Marked outlet to be controlled by automatic means which removes power from the outlet.
 3. Markings:
 - a. Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Controlled Receptacles" Articles.
- C. Single, Duplex Ground Fault with Controlled Receptacle Marking, 125 V, 20 A, Self-Testing: Comply with NEMA WD 1. NEMA WD 6 configuration 5-20R, UL 498 and FS W-C-596.

1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
 - a. Hubbell Incorporated; Wiring Device-Kellems - GFTRST20WMC (dual-controlled).
 - b. Pass & Seymour/Legrand - 2097TRCD (dual-controlled).
2. Description:
 - a. Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two-pole, three-wire, and self-grounding.
 - b. Marked outlet to be controlled by automatic means which removes power from the outlet.
 - c. Type: Feed through.
3. Markings:
 - a. Listed and labeled as complying with NFPA 70, "Controlled Receptacles" Article.

2.08 PENDANT CORD-CONNECTOR DEVICES

- A. Description: Matching, locking-type plug and receptacle body connector, heavy-duty grade.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
 1. Eaton (Arrow Hart).
 2. Hubbell Premise Wiring.
 3. Leviton Manufacturing Co., Inc.
 4. Pass & Seymour/Legrand (Pass & Seymour).
- C. Configuration: NEMA WD 6, Configurations L5-20P and L5-20R.
- D. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
- E. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.
- F. Standards: Comply with FS W-C-596.

2.09 CORD AND PLUG SETS

- A. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
- B. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
- C. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.10 LOCKING RECEPTACLES

- A. NEMA, 125 V, Locking Receptacle:
 - 1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 - 2. General Characteristics:
 - a. Reference Standards: UL CCN RTRT and UL 498.
 - 3. Options:
 - a. Device Color: Black with yellow voltage indication on face.
 - b. Configuration: 2 pole, 3 wire, grounding, (eg. NEMA L5-15R, NEMA L5-20R NEMA L5-30R, or as identified on plan through special receptacle schedule).
- B. NEMA, 250 V, Locking Receptacle:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 - 2. General Characteristics:
 - a. Reference Standards: UL CCN RTRT and UL 498.
 - 3. Options:
 - a. Device Color: Black with blue voltage indication on face.
 - b. Configuration as shown on plans

2.11 TOGGLE SWITCHES

- A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
- B. Switches, 120/277 V, 20 A:
 - 1. Single Pole:
 - 2. Two Pole:
 - 3. Three Way:
 - 4. Four Way:
- C. Pilot-Light Switches: 120/277 V, 20 A.
 - 1. Description: Single pole, with LED-lighted handle, illuminated when switch is off.

2.12 WALL SWITCH SENSOR LIGHT SWITCH, DUAL TECHNOLOGY

- A. Description: Switchbox-mounted, combination lighting-control sensor and conventional switch lighting-control unit using dual technology. Provide dimming where indicated on plans
 - 1. Connections: Hard wired.

2. Rated 960 W at 120-V ac for tungsten lighting, 10 A at 120-V ac or 10 A at 277-V ac for LED lighting, and 1/4 hp at 120-V ac.
3. Adjustable time delay of five to 30 minutes. Set at 20 minutes.
4. Able to be locked to Automatic-On or Manual-On mode . Set as manual on as indicated on plans
5. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc. Set at 70 FC
6. Comply with NEMA WD 1, UL 20, and FS W-S-896.

2.13 WALL PLATES

- A. 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: Smooth, high-impact thermoplastic.
 3. Material for Unfinished Spaces: Galvanized steel.
 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.14 FINISHES

- A. Device Color:
 1. Wiring Devices Connected to Normal Power System: White unless otherwise indicated by architect or required by NFPA 70 or device listing.
 2. Wiring Devices Connected to Emergency Power System: Red unless otherwise indicated or required by NFPA 70 or device listing.
 3. Wiring Devices Connected to panels that are connected to a UPS system where applicable : Identify using blue or a separate color to be selected by Owner.
- B. Wall Plate Color: White unless otherwise indicated by architect or required by NFPA 70 or device listing.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.

3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until 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 meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. AFCI, GFCI and combination AFCI/GFCI circuit breakers are acceptable substitutions for serving circuits in locations where AFCI and GFCI receptacles are required.
2. GFCI receptacle resets must be in readily accessible locations as defined by the electrical code. Locate respective GFCI receptacles accordingly. Where GFI receptacles cannot be installed to be readily accessible, utilize remote GFCI reset devices or utilize GFCI circuit breakers.
3. Provide AFCI devices (or circuit breakers) for all devices located in sleeping quarters (bunk), booking, interview, intox., mental health offices and workroom, check-in/waiting, lobby, vestibule, polygraph rooms and any other areas as required by the electrical code.
4. Provide Tamper-proof devices (and devices plates) for all devices located in all areas except mechanical rooms, electrical rooms, and roof locations.
5. Provide GFCI devices (or circuit breakers) for all devices shown on plans, this shall include but not be limited to: those located in lab, sallyport, bathroom, changing (shower), kitchen, janitor, elevator shaft, break room counter, laundry, mechanical rooms, outdoors, garages, accessory buildings, sheds, crawl spaces or basement areas and any other areas as required by the electrical code.
6. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
7. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
8. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
9. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
10. 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.
11. Use a torque screwdriver when a torque is recommended or required by manufacturer.
12. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
13. Tighten unused terminal screws on the device.

14. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
 1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.
- I. Envelope integrity and sound transmission:
 1. Provide device boxes mounted on exterior walls with Energy Star rated receptacle box vapor barrier; Thomas & Betts, Nutek or equal.
 2. Provide device plate gaskets for boxes mounted on exterior walls with Energy Star rated device gasket; Hubbell, Madison Electric or equal
 3. Utilize fire stop sealant around conduit penetrations to aid with minimizing the sound transmission between each unit and between units and common space
 4. Utilize wall insulation material and device plate gaskets to aid with minimizing the sound transmission between each unit and between units and common space.
 5. Do not install devices back-to-back in walls between units; shift the devices so that they are installed one horizontal stud bay away from each other when mounted on common walls between units.

3.02 SELECTION OF GFCI RECEPTACLES

- A. Unless protection of downstream branch-circuit wiring, cord sets, and power-supply cords is required by NFPA 70 or NFPA 99, provide non-feed-through GFCI receptacles.

3.03 IDENTIFICATION

- A. Comply with Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with white-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.04 FIELD QUALITY CONTROL

- A. Test Instruments: Use instruments that comply with UL 1436.
- B. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

- C. Perform the following tests and inspections:
 - 1. Test Instruments: Use instruments that comply with UL 1436.
 - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- D. Tests for Convenience Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 - 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.
- E. Wiring device will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION

SECTION 26 28 13

FUSES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. Section Includes:
 - 1. Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches, and enclosed controllers.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
 - 1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
 - a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
 - b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
 - 2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 - 3. Current-limitation curves for fuses with current-limiting characteristics.
 - 4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
 - 5. Coordination charts and tables and related data.
 - 6. Fuse sizes for elevator feeders and elevator disconnect switches.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified Division 01, include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
4. Coordination charts and tables and related data.

1.05 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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.06 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.
- 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 NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.

1.07 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.08 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

2.01 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. Cooper Bussmann, Inc.
 2. Edison Fuse, Inc.
 3. Ferraz Shawmut, Inc.
 4. Littelfuse, Inc.

- B. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant

2.02 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 FUSE APPLICATIONS

- A. Cartridge Fuses:
 - 1. Feeders: Class RK1, time delay or Class RK5, time delay.
 - 2. Motor Branch Circuits: Class RK5, time delay.
 - 3. Other Branch Circuits: Class RK1, time delay or Class RK5, time delay.
 - 4. Control Circuits: Class CC, time delay.
- B. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.03 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION

SECTION 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Shunt trip switches.
 - 4. Molded-case circuit breakers (MCCBs).
 - 5. Molded-case switches.
 - 6. Enclosures.

1.03 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.04 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
 2. Current and voltage ratings.
 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
 5. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
1. Wiring Diagrams: For power, signal, and control wiring.

1.06 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For enclosed switches and circuit breakers, 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. 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.
- B. Field quality-control reports.
1. Test procedures used.
 2. Test results that comply with requirements.
 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.07 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.08 QUALITY ASSURANCE

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- 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. Comply with NFPA 70.

1.09 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than **minus 22 deg F (minus 30 deg C)** and not exceeding **104 deg F (40 deg C)**.
 - 2. Altitude: Not exceeding **6600 feet (2010 m)**.
- B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Owner no fewer than five days in advance of proposed interruption of electric service.
 - 2. Indicate method of providing temporary electric service.
 - 3. Do not proceed with interruption of electric service without Owner's written permission.
 - 4. Comply with NFPA 70E.

1.10 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.01 ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant

2.02 FUSIBLE SWITCHES

- 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. [Eaton Electrical Inc.; Cutler-Hammer Business Unit.](#)
 - 2. [General Electric Company; GE Consumer & Industrial - Electrical Distribution.](#)
 - 3. [Siemens Energy & Automation, Inc.](#)
 - 4. [Square D; a brand of Schneider Electric.](#)

- B. Type HD, Heavy Duty, Single Throw, 240 or 600-V ac as appropriate for circuit voltage, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 - 4. Lugs: Mechanical type, suitable for number, size, and conductor material.
 - 5. Service-Rated Switches: Labeled for use as service equipment.

2.03 NONFUSIBLE SWITCHES

- 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. [Eaton Electrical Inc.; Cutler-Hammer Business Unit.](#)
 - 2. [General Electric Company; GE Consumer & Industrial - Electrical Distribution.](#)
 - 3. [Siemens Energy & Automation, Inc.](#)
 - 4. [Square D; a brand of Schneider Electric.](#)
- B. Type HD, Heavy Duty, Single Throw, -240 or 600-V ac as appropriate for circuit voltage, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 - 4. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.04 MOLDED-CASE CIRCUIT BREAKERS

- 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. [Eaton Electrical Inc.; Cutler-Hammer Business Unit.](#)
 - 2. [General Electric Company; GE Consumer & Industrial - Electrical Distribution.](#)
 - 3. [Siemens Energy & Automation, Inc.](#)
 - 4. [Square D; a brand of Schneider Electric.](#)
- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

- C. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
 - 1. Instantaneous trip.
 - 2. Long- and short-time pickup levels.
 - 3. Long- and short-time time adjustments.
 - 4. Ground-fault pickup level, time delay, and I^2t response.
- D. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- E. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- F. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- G. Features and Accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
 - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
 - 4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
 - 5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 - 6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 - 7. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 - 8. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.

2.05 MOLDED-CASE SWITCHES

- 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. [Eaton Electrical Inc.; Cutler-Hammer Business Unit.](#)
 - 2. [General Electric Company; GE Consumer & Industrial - Electrical Distribution.](#)
 - 3. [Siemens Energy & Automation, Inc.](#)
 - 4. [Square D; a brand of Schneider Electric.](#)
- B. General Requirements: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- C. Features and Accessories:
 - 1. Standard frame sizes and number of poles.
 - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.

3. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.

2.06 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 2. Outdoor Locations: NEMA 250, Type 3R.
 3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4X.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Comply with mounting and anchoring requirements specified in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."
- C. Install fuses in fusible devices.
- D. Comply with NECA 1.

3.03 IDENTIFICATION

- A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."
 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.04 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges.

END OF SECTION

SECTION 26 29 13

ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. Section includes the following enclosed controllers rated 600 V and less:
 - 1. Full-voltage manual.
 - 2. Full-voltage magnetic.

1.03 DEFINITIONS

- A. CPT: Control power transformer.
- B. MCCB: Molded-case circuit breaker.
- C. MCP: Motor circuit protector.
- D. N.C.: Normally closed.
- E. N.O.: Normally open.
- F. OCPD: Overcurrent protective device.
- G. SCR: Silicon-controlled rectifier.

1.04 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed controllers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified"

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.
- B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.
 - 1. Show tabulations of the following:
 - a. Each installed unit's type and details.
 - b. Factory-installed devices.
 - c. Nameplate legends.
 - d. Short-circuit current rating of integrated unit.
 - e. Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.
 - 2. Wiring Diagrams: For power, signal, and control wiring.

1.06 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For enclosed controllers, 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. 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.
- B. Field quality-control reports.
- C. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.
- D. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.

1.07 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01, include the following:
 - 1. Routine maintenance requirements for enclosed controllers and installed components.
 - 2. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
 - 3. Manufacturer's written instructions for setting field-adjustable overload relays.

1.08 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than **minus 22 deg F (minus 30 deg C)** and not exceeding **104 deg F (40 deg C)**.
 - 2. Altitude: Not exceeding **6600 feet (2010 m)**.
- B. Interruption of Existing Electrical Systems: Do not interrupt electrical systems in facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - 1. Notify Owner no fewer than five days in advance of proposed interruption of electrical systems.
 - 2. Indicate method of providing temporary utilities.
 - 3. Do not proceed with interruption of electrical systems without Owner's written permission.
 - 4. Comply with NFPA 70E.

1.11 COORDINATION

- A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.01 ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant

2.02 FULL-VOLTAGE CONTROLLERS

- A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.
- B. Motor-Starting Switches: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. [Eaton Electrical Inc.; Cutler-Hammer Business Unit.](#)
 - b. [General Electric Company; GE Consumer & Industrial - Electrical Distribution.](#)
 - c. [Rockwell Automation, Inc.; Allen-Bradley brand.](#)
 - d. [Siemens Energy & Automation, Inc.](#)
 - e. [Square D; a brand of Schneider Electric.](#)
 - 2. Configuration: Nonreversing.
 - 3. Surface mounting.
 - 4. Red pilot light.
- C. Magnetic Controllers: Full voltage, across the line, electrically held.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. [Eaton Electrical Inc.; Cutler-Hammer Business Unit.](#)
 - b. [General Electric Company; GE Consumer & Industrial - Electrical Distribution.](#)
 - c. [Rockwell Automation, Inc.; Allen-Bradley brand.](#)
 - d. [Siemens Energy & Automation, Inc.](#)
 - e. [Square D; a brand of Schneider Electric.](#)
 - 2. Configuration: Nonreversing
 - 3. Contactor Coils: Pressure-encapsulated type.
 - a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
 - 4. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
 - 5. Control Circuits: 120-V ac maximum; obtained from integral CPT, with primary and secondary fuses, of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
 - a. CPT Spare Capacity: 100 VA.

6. Melting Alloy Overload Relays:
 - a. Inverse-time-current characteristic.
 - b. Class 20 tripping characteristic.
 - c. Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
 7. Bimetallic Overload Relays:
 - a. Inverse-time-current characteristic.
 - b. Class 20 tripping characteristic.
 - c. Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
 - d. Ambient compensated.
 - e. Automatic resetting.
 8. Solid-State Overload Relay:
 - a. Switch or dial selectable for motor running overload protection.
 - b. Sensors in each phase.
 - c. Class 20 tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
 9. N.O., isolated overload alarm contact.
 10. External overload reset push button.
- D. Combination Magnetic Controller: Factory-assembled combination of magnetic controller, OCPD, and disconnecting means.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. [Eaton Electrical Inc.; Cutler-Hammer Business Unit.](#)
 - b. [General Electric Company; GE Consumer & Industrial - Electrical Distribution.](#)
 - c. [Rockwell Automation, Inc.; Allen-Bradley brand.](#)
 - d. [Siemens Energy & Automation, Inc.](#)
 - e. [Square D; a brand of Schneider Electric.](#)
 2. Fusible Disconnecting Means:
 - a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate Class R fuses.
 - b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 3. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
 4. MCP Disconnecting Means:
 - a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
 - b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - c. Auxiliary contacts "a" and "b" arranged to activate with MCP handle.

- d. N.O. alarm contact that operates only when MCP has tripped.
 - e. Current-limiting module to increase controller short-circuit current (withstand) rating to 100 kA.
5. MCCB Disconnecting Means:
- a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
 - b. Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - c. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - d. Auxiliary contacts "a" and "b" arranged to activate with MCCB handle.
 - e. N.O. alarm contact that operates only when MCCB has tripped.

2.03 ENCLOSURES

- A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.
- 1. Dry and Clean Indoor Locations: Type 1.
 - 2. Outdoor Locations: Type 3R
 - 3. Other Wet or Damp Indoor Locations: Type 4X.

2.04 ACCESSORIES

- A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.
- 1. Push Buttons, Pilot Lights, and Selector Switches: Heavy-duty, type.
 - a. Push Buttons: Recessed types; momentary.
 - b. Pilot Lights: LED types; colors as indicated; push to test.
 - c. Selector Switches: Rotary type Hand-off-automatic for units with remote automatic control; on-off for units with only local control.
- B. Reversible N.C./N.O. auxiliary contact(s).
- C. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.
- D. Breather and drain assemblies, to maintain interior pressure and release condensation in Type 4X enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 26 05 29 "Hangers and Supports for Electrical Systems."
- B. Seismic Bracing: Comply with requirements specified in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."
- C. Install fuses in each fusible-switch enclosed controller.
- D. Install fuses in control circuits if not factory installed. Comply with requirements in Section 26 28 13 "Fuses."
- E. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.
- F. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.
- G. Comply with NECA 1.

3.03 IDENTIFICATION

- A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved nameplate.
 - 3. Label each enclosure-mounted control and pilot device.

3.04 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:

1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
 2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
 3. Test continuity of each circuit.
 4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Architect before starting the motor(s).
 5. Test each motor for proper phase rotation.
 6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Enclosed controllers will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

- A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
- B. Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.
- C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Architect before increasing settings.
- D. Set field-adjustable circuit-breaker trip ranges.

3.06 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.
- B. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.07 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers

END OF SECTION

SECTION 26 51 19

LED INTERIOR LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. Section includes LED luminaires and luminaire supports.
- B. Related Requirements:
 - 1. Section 26 09 23 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
 - 2. Section 26 09 43.16 "Addressable-Luminaire Lighting Controls" and Section 26 09 43.23 "Relay-Based Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.

1.03 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Arrange in order of luminaire designation.
 - 2. Include data on features, accessories, and finishes.

3. Include physical description and dimensions of luminaires.
 4. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
 5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project IES LM-79 and IES LM-80.
 - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Samples for Verification: as requested during submittal review.
1. Include Samples of luminaires and accessories to verify finish selection.
- C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.05 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For luminaires, 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. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
- B. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Product Certificates: For each type of luminaire.
- D. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.
- E. Sample warranty.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.07 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. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.

2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.08 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Provide luminaires from a single manufacturer for each luminaire type.
- C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE 7.
 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified."
- B. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant

2.02 LUMINAIRE REQUIREMENTS

- 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. Standards:
 1. ENERGY STAR certified or listed by the DesignLights Consortium (DLC).
 2. UL Listing: Listed for damp location.

3. Recessed luminaires shall comply with NEMA LE 4.
4. User Replaceable Lamps:
 - a. Bulb shape complying with ANSI C78.79.
 - b. Lamp base complying with ANSI C81.61 or IEC 60061-1.
- C. Rated lamp life of 50,000 hours to L70.
- D. Lamps dimmable from 100 percent to 1 percent of maximum light output.
- E. Internal driver. For luminaires indicated for individually addressable control, provide individually addressable DALI drivers that are compatible with the system specified in Section 26 09 43.16 "Addressable Luminaire Lighting Controls".
- F. Nominal Operating Voltage: As scheduled on the drawings.
 1. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

2.03 MATERIALS

- A. Metal Parts:
 1. Free of burrs and sharp corners and edges.
 2. Sheet metal components shall be steel unless otherwise indicated.
 3. Form and support to prevent warping and sagging.
- B. 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.
- C. Diffusers and Globes:
 1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 2. Glass: Annealed crystal glass unless otherwise indicated.
 3. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
- D. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 1. Label shall include the following lamp characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter, shape, size, wattage, and coating.
 - c. CCT and CRI for all luminaires.

2.04 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.05 LUMINAIRE SUPPORT

- A. Comply with requirements in Section 26 05 29 "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 (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gauge (2.68 mm).
- D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.01 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 luminaire to verify actual locations of luminaire and electrical connections before luminaire installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 TEMPORARY LIGHTING

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.03 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 3. Provide support for luminaire without causing deflection of ceiling or wall.
 - 4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.
- E. Flush-Mounted Luminaire Support:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls or attached to a minimum 20 gauge backing plate attached to wall structural members.
2. Do not attach luminaires directly to gypsum board.

G. Ceiling-Mounted Luminaire Support:

1. Ceiling mount with two **5/32-inch- (4-mm-)** diameter aircraft cable supports adjustable to **120 inches (6 m)** in length.
2. Ceiling mount with pendant mount with **5/32-inch- (4-mm-)** diameter aircraft cable supports adjustable to **120 inches (6 m)** in length.

H. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than **48 inches (1200 mm)**, brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

I. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

- J. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.04 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.05 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

3.06 STARTUP SERVICE

- A. Comply with requirements for startup specified in Section 26 09 43.16 "Addressable-Luminaire Lighting Controls."

3.07 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
 1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION

SECTION 26 52 19

EMERGENCY AND EXIT LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. Section Includes:
 - 1. Emergency lighting units.
 - 2. Exit signs.
 - 3. Luminaire supports.

1.03 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Emergency Lighting Unit: A lighting unit with internal or external emergency battery powered supply and the means for controlling and charging the battery and unit operation.
- D. Fixture: See "Luminaire" Paragraph.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support.
 - 1. Include data on features, accessories, and finishes.
 - 2. Include physical description of the unit and dimensions.
 - 3. Battery and charger for light units.
 - 4. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.
 - 5. Include photometric data and adjustment factors based on laboratory tests, complying with IES LM-45, for each luminaire type.

- a. Testing Agency Certified Data: For indicated luminaires and signs, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires and signs shall be certified by manufacturer.
 - b. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Shop Drawings: For nonstandard or custom luminaires.
 - 1. Include plans, elevations, sections, and mounting and attachment 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.
- C. Samples: For each product and for each color and texture specified.
- D. Samples for Initial Selection: For each type of luminaire with factory-applied finishes.
- E. Samples for Verification: For each type of luminaire.
 - 1. Include Samples of luminaires and accessories to verify finish selection.
- F. Product Schedule:
 - 1. For emergency lighting units. Use same designations indicated on Drawings.
 - 2. For exit signs. Use same designations indicated on Drawings.

1.05 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. Luminaires.
 - 2. Suspended ceiling components.
 - 3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
 - 4. Structural members to which equipment will be attached.
 - 5. Size and location of initial access modules for acoustical tile.
 - 6. Items penetrating finished ceiling including the following:
 - a. Other luminaires.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Ceiling-mounted projectors.
 - e. Sprinklers.
 - f. Access panels.
 - 7. Moldings.
- B. Qualification Data: For testing laboratory providing photometric data for luminaires.
- C. Product Certificates: For each type of luminaire.

- D. Seismic Qualification Certificates: For luminaires, 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. 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.
- E. Product Test Reports: For each luminaire for tests performed by manufacturer and witnessed by a qualified testing agency.
- F. Sample Warranty: For manufacturer's warranty.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.
 - 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.07 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. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
 - 2. Luminaire-mounted, emergency battery pack: One for every 50 emergency lighting units. Furnish at least one of each type.
 - 3. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - 4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.08 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. 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 1910.7, accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

- D. Mockups: For interior luminaires in room or module mockups, complete with power and control connections.
 - 1. Obtain Architect's approval of luminaires and signs in mockups before starting installations.
 - 2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two year(s) from date of Substantial Completion.
- B. 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 Power Unit Batteries: 5 years from date of Substantial Completion. Full warranty shall apply for the entire warranty period.
 - 2. Warranty Period for Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for the entire warranty period.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7. Luminaires and lamps shall be labeled vibration and shock resistant.
 - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."
- B. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant

2.02 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

- 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. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.
- C. Comply with NFPA 70 and NFPA 101.
- D. Comply with NEMA LE 4 for recessed luminaires.
- E. Comply with UL 1598 for fluorescent luminaires.
- F. Lamp Base: Comply with IEC 60061-1.
- G. Bulb Shape: Complying with ANSI C79.1.

2.03 EMERGENCY LIGHTING

- A. General Requirements for Emergency Lighting Units: Self-contained units.
- B. Emergency Luminaires:
 - 1. Emergency Luminaires: as indicated on Interior Lighting Fixture Schedule on Drawings, with the following additional features:
 - a. Operating at nominal voltage of 277 V ac.
 - b. External emergency power unit.
 - c. Rated for installation in damp locations, and for sealed and gasketed luminaires in wet locations.
 - d. UL 94 5VA flame rating.
- C. Emergency Lighting Unit:
 - 1. Emergency Lighting Unit: as indicated on Interior Lighting Fixture Schedule on Drawings.
 - 2. Operating at nominal voltage of 277 V ac.
 - 3. Wall with universal junction box adaptor.
 - 4. UV stable thermoplastic housing, rated for damp locations.
 - 5. Two LED lamp heads.
 - 6. External emergency power unit.
- D. Remote Emergency Lighting Units:
 - 1. Emergency Lighting Unit: as indicated on Interior Lighting Fixture Schedule on Drawings.
 - 2. Operating at nominal voltage of 277 V ac.
 - 3. Wall with universal junction box adaptor.
 - 4. UV stable thermoplastic housing, rated for damp locations.
 - 5. Two LED lamp heads.
 - 6. External emergency power unit.

2.04 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. Operating at nominal voltage of 277 V ac.
 - 2. Lamps for AC Operation: Fluorescent, two for each luminaire; 20,000 hours of rated lamp life.
 - 3. Lamps for AC Operation: LEDs; 50,000 hours minimum rated lamp life.
 - 4. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.
 - 5. Master/Remote Sign Configurations:
 - a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply for power connection to remote unit.
 - b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery, and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.
- C. Self-Luminous Signs:
 - 1. Powered by tritium gas, with universal bracket for flush-ceiling, wall, or end mounting. Signs shall be guaranteed by manufacturer to maintain the minimum brightness requirements in UL 924 for 20 years.
 - 2. Use strontium oxide aluminate compound to store ambient light and release the stored energy when the light is removed. Include universal bracket for flush-ceiling, wall, or end mounting.
 - 3. These devices are utilized where at floor level egress signs are required by the applicable building and life safety codes or as identified on the architectural plans or details.

2.05 MATERIALS

- A. Metal Parts:
 - 1. Free of burrs and sharp corners and edges.
 - 2. Sheet metal components shall be steel unless otherwise indicated.
 - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access:
 - 1. Smooth operating, free of light leakage under operating conditions.
 - 2. Designed to permit relamping without use of tools.
 - 3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Diffusers and Globes:
 - 1. Clear, UV-stabilized acrylic.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.
 - 3. Acrylic: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

- 4. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
- D. Housings:
 - 1. Extruded aluminum housing and heat sink.
 - 2. Clear anodized finish.
- E. Conduit: Electrical metallic tubing, minimum 3/4 inch in diameter.

2.06 METAL FINISHES

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.07 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Support Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
 - 1. Sized and rated for luminaire and emergency power unit weight.
 - 2. Able to maintain luminaire position when testing emergency power unit.

3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of luminaire weight.

E. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.
2. Do not attach luminaires directly to gypsum board.

F. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

G. Ceiling Grid Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

3.03 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.04 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

3.05 STARTUP SERVICE

- A. Perform startup service:

1. Charge emergency power units and batteries minimum of 24 hours and conduct one-hour discharge test.

3.06 ADJUSTING

- A. Adjustments: Within 12 months of date of Substantial Completion, provide on-site visit to do the following:
 1. Inspect all luminaires. Replace lamps, emergency power units, batteries, signs, or luminaires that are defective.
 - a. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 2. Conduct short-duration tests on all emergency lighting.

END OF SECTION

SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. Section Includes:
 - 1. Exterior luminaires with LED arrays and drivers.
 - 2. Luminaire-mounted photoelectric relays.
 - 3. Poles and accessories.
- B. Related Sections:
 - 1. Section 26 51 19 "LED Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

1.03 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color-rendering index.
- C. HID: High-intensity discharge.
- D. LED: Light emitting diode
- E. LER: Luminaire efficacy rating.
- F. Luminaire: Complete lighting fixture, including ballast housing if provided.
- G. Pole: Luminaire support structure, including tower used for large area illumination.
- H. Standard: Same definition as "Pole" above.

1.04 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

- A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.

- B. Live Load: Single load of 500 lbf (2224 N), distributed as stated in AASHTO LTS-4-M.
- C. Ice Load: Load of 3 lbf/sq. ft. (145 Pa), applied as stated in AASHTO LTS-4-M Ice Load Map.
- D. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M.
 - 1. Basic wind speed for calculating wind load for poles 50 feet (15 m) high or less is 90 mph (40 m/s).
 - a. Wind Importance Factor: 1.0.
 - b. Minimum Design Life: 25 years.
 - c. Velocity Conversion Factors: 1.0.

1.05 ACTION SUBMITTALS

- A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
 - 2. Details of attaching luminaires and accessories.
 - 3. Details of installation and construction.
 - 4. Luminaire materials.
 - 5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
 - a. Manufacturer Certified Data: Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
 - 6. Photoelectric relays.
 - 7. Ballasts, including energy-efficiency data.
 - 8. Lamps, including life, output, CCT, CRI, lumens, and energy-efficiency data.
 - 9. Materials, dimensions, and finishes of poles.
 - 10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
 - 11. Anchor bolts for poles.
 - 12. Manufactured pole foundations.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
 - 3. Wiring Diagrams: For power, signal, and control wiring.

1.06 INFORMATIONAL SUBMITTALS

- A. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4-M and that load

imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations by a professional engineer.

- B. Field quality-control reports.
- C. Warranty: Sample of special warranty.

1.07 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.

1.08 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. Lamps: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - 2. Glass and Plastic Lenses, Covers, and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - 3. Ballasts: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - 4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.09 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- 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 IEEE C2, "National Electrical Safety Code."
- D. Comply with NFPA 70.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Store poles on decay-resistant-treated skids at least **12 inches (300 mm)** above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.
- B. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.
 - 1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
 - 2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
 - 3. Warranty Period for Color Retention: Five years from date of Substantial Completion.
 - 4. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.
- B. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant

2.02 GENERAL REQUIREMENTS FOR LUMINAIRES

- A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
 - 1. LER Tests Incandescent Fixtures: Where LER is specified, test according to NEMA LE 5A.
 - 2. LER Tests HID Fixtures: Where LER is specified, test according to NEMA LE 5B.
- B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- F. 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. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

- G. Exposed Hardware Material: Stainless steel.
- H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.
- J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
- K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- M. Factory-Applied Finish for Steel luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
 - 2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: As selected from manufacturer's standard catalog of colors.
- N. Factory-Applied Finish for Aluminum luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 - 2. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
 - a. Color: As selected by Architect from manufacturer's standard catalog of colors.
- O. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps/LED engines and ballasts/drivers. 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.

2.03 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

- A. Comply with UL 773 or UL 773A.
- B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at **1.5 to 3 fc (16 to 32 lx)** and off at **4.5 to 10 fc (48 to 108 lx)** with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.
 - 1. Relay with locking-type receptacle shall comply with ANSI C136.10.
 - 2. Adjustable window slide for adjusting on-off set points.

2.04 DRIVERS FOR LED ENGINES

- A. UL 1598, suitable for Wet Locations.
- B. RoHS compliant.
- C. Design Lights Consortium (DLC) Certified.
- D. Housing: IP 66 rating.
- E. Voltage: Unit accepts 120V through 277V, 50hz to 60hz input.
- F. Output based on wattage of LED array.
- G. Include plug type disconnect.
- H. Power factor shall not be less than 90 percent.

2.05 LED LIGHT ENGINES

- A. Array wattage shall be as scheduled on the drawings plus or minus 8 percent for ambient temperature and forward voltage.
- B. Minimum Lumen Output: As scheduled on the drawings based on IESNA LM-79 or LM-80 testing.
- C. Color Temperature: As scheduled on the drawings with minimum 70 CRI.
- D. Lumen depreciation: 70 percent of initial output after 215,000 hours at a temperature of 40°C using IESNA LM-80 methodology.

2.06 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

- A. Structural Characteristics: Comply with AASHTO LTS-4-M.
 - 1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.

2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.
- B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.
- C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
 1. Materials: Shall not cause galvanic action at contact points.
 2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
 3. Anchor-Bolt Template: Plywood or steel.
- D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches (65 by 130 mm), with cover secured by stainless-steel captive screws.
- E. Concrete Pole Foundations: Pre-cast, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03.

2.07 STEEL POLES

- A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig (317 MPa); one-piece construction up to 40 feet (12 m) in height with access handhole in pole wall.
 1. Shape: Square, straight.
 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
- B. Brackets for Luminaires: Detachable, cantilever, without underbrace.
 1. Adapter fitting welded to pole, allowing the bracket to be bolted to the pole mounted adapter, then bolted together with stainless-steel bolts.
 2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
 3. Match pole material and finish.
- C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- D. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- E. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.
- F. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."
2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: As selected by Architect from manufacturer's standard colors.

2.08 POLE ACCESSORIES

- A. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

PART 3 - EXECUTION

3.01 LUMINAIRE INSTALLATION

- A. Install lamps in each luminaire.
- B. Fasten luminaire to indicated structural supports.
 1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

3.02 POLE INSTALLATION

- A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.
- B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:
 1. Fire Hydrants and Storm Drainage Piping: **60 inches (1520 mm)**.
 2. Water, Gas, Electric, Communication, and Sewer Lines: five feet.
 3. Trees: **15 feet (5 m)** from tree trunk.
- C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03.
- D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.

1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
 2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
 3. Install base covers unless otherwise indicated.
 4. Use a short piece of **1/2-inch- (13-mm-)** diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
- E. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of **6-inch- (150-mm-)** wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level **1 inch (25 mm)** below top of concrete slab.
- F. Raise and set poles using web fabric slings (not chain or cable).

3.03 BOLLARD LUMINAIRE INSTALLATION

- A. Align units for optimum directional alignment of light distribution.
- B. Install on concrete base with top **4 inches (100 mm)** above finished grade or surface at bollard location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 03.

3.04 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Section 26 05 33 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with **0.010-inch- (0.254-mm-)** thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.05 GROUNDING

- A. Ground metal poles and support structures according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
1. Install grounding electrode for each pole unless otherwise indicated.
 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.06 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
1. Verify operation of photoelectric controls.

- C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION

SECTION 27 11 00

COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. Section Includes:
 - 1. Telecommunications mounting elements.
 - 2. Backboards.
 - 3. Telecommunications service entrance pathways.
 - 4. Grounding.
- B. Related Sections:
 - 1. Division 28 Section "Conductors and Cables for Electronic Safety and Security" for voice and data cabling associated with system panels and devices.

1.03 DEFINITIONS

- A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
- B. BICSI: Building Industry Consulting Service International.
- C. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
- D. LAN: Local area network.
- E. RCDD: Registered Communications Distribution Designer.

1.04 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Floor-mounted cabinets and cable pathways shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1.05 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
 - 3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
- 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. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- D. Grounding: Comply with ANSI-J-STD-607-A.

1.07 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

1.08 COORDINATION

- A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.
 - 1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
 - 2. Record agreements reached in meetings and distribute them to other participants.
 - 3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
 - 4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.
- B. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

PART 2 - PRODUCTS

2.01 ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant

2.02 PATHWAYS

- A. General Requirements: Comply with TIA/EIA-569-A.
- B. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.
 - 1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
 - 2. Support brackets with cable tie slots for fastening cable ties to brackets.
 - 3. Lacing bars, spools, J-hooks, and D-rings.
 - 4. Straps and other devices.
- C. Cable Trays:
 - 1. Manufacturers: provide products by one of the following or approved equal:
 - a. Cable Management Solutions, Inc.
 - b. Cooper B-Line, Inc.
 - c. Cope - Tyco/Allied Tube & Conduit.
 - d. GS Metals Corp.
 - 2. Cable Tray Materials: Metal, suitable for indoors and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch thick.
 - a. **Ladder Cable Trays: Nominally 12 or 24 inches wide, and a rung spacing of 12 inches. Refer to plans, details and port plans for specific cable tray widths in each room or area application.**
- D. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems."
 - 1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

2.03 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels specified in Division 06 Section "Rough Carpentry."

2.04 POWER STRIPS

- A. Power Strips: Comply with UL 1363.
 - 1. **Rack mounting; provide one power strip for each dedicated rack power receptacle.**
 - 2. Six 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R receptacles.
 - 3. LED indicator lights for power and protection status.
 - 4. LED indicator lights for reverse polarity and open outlet ground.
 - 5. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
 - 6. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
 - 7. Rocker-type on-off switch, illuminated when in on position.
 - 8. Peak Single-Impulse Surge Current Rating: 33 kA per phase.
 - 9. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all 3 modes shall be not more than 330 V.
 - 10. **Coordinate with owner for desired manufacturer and model number**

2.05 GROUNDING

- A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems." for grounding conductors and connectors.
- B. Telecommunications Main Bus Bar:
 - 1. Provide Bus Bars at each IT room.
 - 2. Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
 - 3. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide with 9/32-inch holes spaced 1-1/8 inches apart.
 - 4. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.
- C. Comply with ANSI-J-STD-607-A.

2.06 LABELING

- A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.01 ENTRANCE FACILITIES

- A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.
- B. Install underground pathways complying with recommendations in TIA/EIA-569-A, "Entrance Facilities" Article.
- C. Provide protected entrance terminals in the Communications building for tel/data/catv services fed underground from the main building to any site telecommunications locations.

3.02 Install underground entrance pathway complying with Division 26 Section "Raceway and Boxes for Electrical Systems."INSTALLATION

- A. Comply with NECA 1.
- B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.
- C. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.
- D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.03 FIRESTOPPING

- A. Comply with requirements in Division 07 Section "Penetration Firestopping. "Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.04 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.
 - 1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.05 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Division 26 Section "Identification for Electrical Systems." Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- B. See Division 27 Section "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion of TIA/EIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration.
- C. Labels shall be preprinted or computer-printed type.

END OF SECTION

SECTION 28 05 13

CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. Section Includes:
 - 1. RS-232 cabling.
 - 2. RS-485 cabling.
 - 3. Low-voltage control cabling.
 - 4. Control-circuit conductors.
 - 5. Fire alarm wire and cable.
 - 6. Identification products.

1.03 RELATED SECTIONS

- A. Network cabling shall comply with Division 27.

1.04 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
- C. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For coaxial cable, include the following installation data for each type used:
 - a. Nominal OD.
 - b. Minimum bending radius.
 - c. Maximum pulling tension.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
- B. Source quality-control reports.
- C. Field quality-control reports.

1.07 FIELD CONDITIONS

- A. Do not install conductors and cables that are wet, moisture damaged, or mold damaged.
 - 1. Indications that wire and cables are wet or moisture damaged include, but are not limited to, discoloration and sagging of factory packing materials.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. 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: 25 or less.
 - 2. Smoke-Developed Index: 50 or less.
- 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. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant

2.02 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, **3/4 by 48 by 96 inches (19 by 1220 by 2440 mm)**. Comply with requirements for plywood backing panels in Section 06 10 00 "Rough Carpentry."

2.03 RS-232 CABLE

- A. Plenum-Rated Cable: NFPA 70, Type CMP.
 - 1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
 - 2. Plastic insulation.
 - 3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 - 4. Plastic jacket.
 - 5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 - 6. Flame Resistance: Comply with NFPA 262.

2.04 RS-485 CABLE

- A. Plenum-Rated Cable: NFPA 70, Type CMP.
 - 1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
 - 2. Fluorinated ethylene propylene insulation.
 - 3. Unshielded.
 - 4. Fluorinated ethylene propylene jacket.
 - 5. Flame Resistance: NFPA 262, Flame Test.

2.05 LOW-VOLTAGE CONTROL CABLE

- A. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
 - 1. One pair, twisted, No. 16 AWG, stranded (19x29) and No. 18 AWG, stranded (19x30) tinned copper conductors.
 - 2. PVC insulation.
 - 3. Unshielded.
 - 4. PVC jacket.
 - 5. Flame Resistance: Comply with NFPA 262.

2.06 CONTROL-CIRCUIT CONDUCTORS

- A. Class 1 Control Circuits: Copper, Type THHN-THWN, complying with UL 83, in raceway or MC cable as specified in Part 3.
- B. Class 2 Control Circuits: Stranded copper, power-limited cable, complying with UL 83, concealed in building finishes. Install cable in metal raceways where specified in Part 3.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83. Install cable in metal raceways where specified in Part 3.

2.07 FIRE ALARM WIRE AND CABLE

- 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. [Comtran Corporation.](#)
 - 2. [Draka Cableteq USA.](#)
 - 3. [Genesis Cable Products; Honeywell International, Inc.](#)
 - 4. [West Penn Wire.](#)
- B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
- C. Signaling Line Circuits:
 - 1. Twisted, shielded pair in metal raceway, size as recommended by system manufacturer but not less than No. 18 AWG.
 - 2. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with red identifier stripe, NRTL listed for fire alarm and cable tray installation, plenum rated..

- D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
 - 1. Low-Voltage Circuits: No. 16 AWG, minimum.
 - 2. Line-Voltage Circuits: No. 12 AWG, minimum.
 - 3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with red identifier stripe, NTRL listed for fire alarm and cable tray installation, plenum rated.

2.08 IDENTIFICATION PRODUCTS

- 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. [Brady Worldwide, Inc.](#)
 - 2. [Kroy LLC.](#)
 - 3. [Panduit Corp.](#)
- B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- C. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

PART 3 - EXECUTION

3.01 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for installation of supports for cables.

3.02 WIRING METHOD

- A. Install cable, concealed in accessible ceilings, and walls in finished areas.
- B. Install wiring in metal pathways and wireways where exposed in mechanical rooms and at exposed structural ceilings.
 - 1. Minimum conduit size shall be ½-inch. Control and data transmission wiring shall not share conduit with other building wiring systems.
- C. Wiring within Enclosures:
 - 1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
 - 2. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer.
 - 3. Install conductors parallel with or at right angles to sides and back of enclosure.
 - 4. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks.
 - 5. Mark each terminal according to system's wiring diagrams.

6. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. Conductors: Size according to system manufacturer's written instructions unless otherwise indicated.
- C. General Requirements for Cabling:
 1. Cables may not be spliced. Secure and support cables at intervals not exceeding **30 inches (760 mm)** and not more than **6 inches (150 mm)** from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 2. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
 3. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 4. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
- D. Open-Cable Installation:
 1. Suspend copper cable not in a wireway or pathway a minimum of **8 inches (200 mm)** above ceilings by cable supports not more than **60 inches (1525 mm)** apart.
 2. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

3.04 FIRE ALARM WIRING INSTALLATION

- A. Comply with NECA 1 and NFPA 72.
- B. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
- C. Signaling Line Circuits: Power-limited fire alarm cables may be installed in the same cable or raceway as signaling line circuits.
- D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

- F. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- G. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.
- H. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.05 POWER AND CONTROL-CIRCUIT CONDUCTORS

- A. 120-V Power Wiring: Install according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.
- B. Minimum Conductor Sizes:
 - 1. Class 1 remote-control and signal circuits, No. 14 AWG.
 - 2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
 - 3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.06 CONNECTIONS

- A. Comply with requirements in Section 28 31 11 "Digital, Addressable Fire-Alarm System for connecting, terminating, and identifying wires and cables.

3.07 FIRESTOPPING

- A. Comply with requirements in Division 07.

3.08 GROUNDING

- A. For low-voltage wiring and cabling, comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems."

3.09 IDENTIFICATION

- A. Identify system components, wiring, and cabling. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.10 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
- B. Prepare test and inspection reports.

END OF SECTION

SECTION 28 46 21.11

ADDRESSABLE FIRE-ALARM SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 1 Appendix B: DOC Standard Terms and Conditions (BABAA).

1.02 SUMMARY

- A. Section Includes:
 - 1. Existing fire-alarm system to be modified.
 - 2. Addressable fire-alarm system.
 - 3. Fire-alarm control unit (FACU).
 - 4. Manual fire-alarm boxes.
 - 5. System smoke detectors.
 - 6. Duct smoke detectors.
 - 7. Projected beam smoke detectors.
 - 8. Carbon monoxide detectors.
 - 9. Heat detectors.
 - 10. Continuous linear heat detector system.
 - 11. Multicriteria and multisensor fire detectors.
 - 12. Nonsystem smoke detectors.
 - 13. Air-sampling smoke detectors.
 - 14. Fire-alarm notification appliances.
 - 15. Exit-marking audible notification appliances.
 - 16. Firefighters' two-way telephone communication service.
 - 17. Emergency responder radio coverage system.
 - 18. Firefighters' smoke-control system.
 - 19. Fire-alarm graphic annunciators.
 - 20. Fire-alarm remote annunciators.
 - 21. Fire-alarm addressable interface devices.
 - 22. Digital alarm communicator transmitters (DACTs).
 - 23. Fire-alarm radio transmitters.
 - 24. Video smoke detection.
- B. Related Requirements:
 - 1. Section 08 71 00 "Door Hardware" for magnetic door holders that release in response to fire-alarm outputs.
 - 2. Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" or Section 26 05 23 "Control Voltage Electrical Power Cables" for cables and conductors for fire-alarm systems.

3. Section 28 47 00 "Mass Notification" for mass notification features that are required in addition to fire-alarm system and equipment requirements specified in this Section.

1.03 DEFINITIONS

- A. DACT: Digital alarm communicator transmitter.
- B. EMT: Electrical metallic tubing.
- C. FACU: Fire-alarm control unit.
- D. High-Performance Building: A building that integrates and optimizes on a life-cycle basis all major high-performance attributes, including energy conservation, environment, safety, security, durability, accessibility, cost-benefit, productivity, sustainability, functionality, and operational considerations.
- E. Mode: The terms "Active Mode," "Off Mode," and "Standby Mode" are used as defined in the 2007 Energy Independence and Security Act (EISA).
- F. NICET: National Institute for Certification in Engineering Technologies.
- G. PC: Personal computer.
- H. Voltage Class: For specified circuits and equipment, voltage classes are defined as follows:
 1. Control Voltage: Listed and labeled for use in remote-control, signaling, and power-limited circuits supplied by a Class 2 or Class 3 power supply having rated output not greater than 150 V and 5 A, allowing use of alternate wiring methods complying with NFPA 70, Article 725.
 2. Low Voltage: Listed and labeled for use in circuits supplied by a Class 1 or other power supply having rated output not greater than 1000 V, requiring use of wiring methods complying with NFPA 70, Article 300, Part I.

1.04 SEQUENCING AND SCHEDULING

- A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. When new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service, and label existing fire-alarm equipment "NOT IN SERVICE" until removed from building.
- B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.05 ACTION SUBMITTALS

- A. Approved Permit Submittal: Submittals must be approved by authorities having jurisdiction prior to submitting them to Architect.
- B. Product Data: For each type of product, including furnished options and accessories.
 1. Include construction details, material descriptions, dimensions, profiles, and finishes.
 2. Include rated capacities, operating characteristics, and electrical characteristics.

C. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in "Documentation" section of "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, and details, including details of attachments to other Work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. **Graphic Annunciator** panel details as required by authorities having jurisdiction.
5. Detail assembly and support requirements.
6. Include voltage drop calculations for notification-appliance circuits.
7. Include battery-size calculations.
8. Include input/output matrix.
9. Include written statement from manufacturer that equipment and components have been tested as a system and comply with requirements in this Section and in NFPA 72.
10. Include performance parameters and installation details for each detector.
11. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
12. Provide program report showing that air-sampling detector pipe layout balances pneumatically within airflow range of air-sampling detector.
13. Provide control wiring diagrams for fire-alarm interface to HVAC; coordinate location of duct smoke detectors and access to them.
 - a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
 - b. Show field wiring **and equipment** required for HVAC unit shutdown on alarm **and override by firefighters' smoke-evacuation system**.
 - c. Locate detectors in accordance with manufacturer's written instructions.
 - d. Show air-sampling detector pipe routing.
14. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
15. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

D. Delegated Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1. Drawings showing location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of device.
2. Design Calculations: Calculate requirements for selecting spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.06 INFORMATIONAL SUBMITTALS

- A. Certificates:
 - 1. Seismic Performance Certificates: For FACU, accessories, and components, from manufacturer. Include the following information:
 - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which certification is based and their installation requirements.
- B. Field quality-control reports.
- C. Qualification Statements: For Installer.
- D. Sample Warranty: Submittal must include line item pricing for replacement parts and labor.

1.07 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following **and deliver copies to authorities having jurisdiction**:
 - a. Comply with "Records" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - b. Provide "Fire-Alarm and Emergency Communications System Record of Completion Documents" in accordance with "Completion Documents" Article in "Documentation" section of "Fundamentals" chapter in NFPA 72.
 - c. Complete wiring diagrams showing connections between devices and equipment. Each conductor must be numbered at every junction point with indication of origination and termination points.
 - d. Riser diagram.
 - e. Device addresses.
 - f. Air-sampling system sample port locations and modeling program report showing layout meets performance criteria.
 - g. Record copy of site-specific software.
 - h. Provide "Inspection and Testing Form" in accordance with "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
 - 1) Equipment tested.
 - 2) Frequency of testing of installed components.
 - 3) Frequency of inspection of installed components.
 - 4) Requirements and recommendations related to results of maintenance.
 - 5) Manufacturer's user training manuals.

- i. Manufacturer's required maintenance related to system warranty requirements.
- j. Abbreviated operating instructions for mounting at FACU and each annunciator unit.

B. Software and Firmware Operational Documentation:

- 1. Software operating and upgrade manuals.
- 2. Program Software Backup: On **USB media and approved online or cloud solution**.
- 3. Device address list.
- 4. Printout of software application and graphic screens.

1.08 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- 1. Lamps for Remote Indicating Lamp Units: Quantity equal to **10** percent of amount installed, but no fewer than one unit.
- 2. Lamps for Strobe Units: Quantity equal to **10** percent of amount installed, but no fewer than one unit.
- 3. Smoke Detectors, Fire Detectors, **and Flame Detectors**: Quantity equal to **10** percent of amount of each type installed, but no fewer than one unit of each type.
- 4. Detector Bases: Quantity equal to **two** percent of amount of each type installed, but no fewer than one unit of each type.
- 5. Keys and Tools: One extra set for access to locked or tamperproofed components.
- 6. Audible and Visual Notification Appliances: **One** of each type installed.
- 7. Fuses: **Two** of each type installed in system. Provide in box or cabinet with compartments marked with fuse types and sizes.
- 8. Filters for Air-Sampling Detectors: Quantity equal to **two** percent of amount of each type installed, but no fewer than one unit of each type.
- 9. Air-Sampling Fan: Quantity equal to **one** for every five detectors, but no fewer than one unit of each type.

1.09 QUALITY ASSURANCE

A. Installer Qualifications:

- 1. Personnel must be trained and certified by manufacturer for installation of units required for this Project.
- 2. Installation must be by personnel certified by NICET as fire-alarm **Level III** technician or a technician's whose qualifications and experience are accepted by the Designer of Record (DOR).
- 3. Obtain certification by NRTL in accordance with NFPA 72.
- 4. Licensed or certified by authorities having jurisdiction.

1.10 FIELD CONDITIONS

A. Seismic Conditions: Unless otherwise indicated on Contract Documents, specified Work in this Section must withstand the seismic hazard design loads determined in accordance with **ASCE/SEI 7** for installed elevation above or below grade.

1. The term "withstand" means "unit must remain in place without separation of parts from unit when subjected to specified seismic design loads.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail because of defects in materials or workmanship within specified warranty period.
 1. Warranty Period: **Five** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 EXISTING FIRE-ALARM SYSTEM TO BE MODIFIED

- A. Source Limitations for Fire-Alarm System and Components: Components must be compatible with, and operate as extension of, existing system. Provide system manufacturer's certification that components provided have been tested as, and will operate as, a system.
- B. ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components. (BABAA) Build America, Buy America Act Compliant

2.02 ADDRESSABLE FIRE-ALARM SYSTEM

- A. Description:
 1. Noncoded, **UL-certified** addressable system, with multiplexed signal transmission and **voice** or **horn**-and-strobe notification for evacuation.
- B. Performance Criteria:
 1. Regulatory Requirements:
 - a. Fire-Alarm Components, Devices, and Accessories: Listed and labeled by a NRTL in accordance with NFPA 70 for use with selected fire-alarm system and marked for intended location and application.
 2. General Characteristics:
 - a. Automatic sensitivity control of certain smoke detectors.
 - b. Fire-alarm signal initiation must be by one or more of the following devices **and systems**:
 - 1) Manual stations.
 - 2) Heat detectors.
 - 3) Flame detectors.
 - 4) Smoke detectors.
 - 5) Duct smoke detectors.
 - 6) Air-sampling smoke-detection system.
 - 7) Carbon monoxide detectors.

- 8) Combustible gas detectors.
- 9) Automatic sprinkler system water flow.
- 10) Preaction system.
- 11) Fire-extinguishing system operation.
- 12) Fire standpipe system.
- 13) Dry system pressure flow switch.
- 14) Fire pump running.

c. Fire-alarm signal must initiate the following actions:

- 1) Continuously operate alarm notification appliances, **including voice evacuation notices.**
- 2) Identify alarm and specific initiating device at FACU, **connected network control panels, off-premises network control panels, and remote annunciators.**
- 3) Transmit alarm signal to remote alarm receiving station.
- 4) Unlock electric door locks in designated egress paths.
- 5) Release fire and smoke doors held open by magnetic door holders.
- 6) Activate voice/alarm communication system.
- 7) Switch HVAC equipment controls to fire-alarm mode.
- 8) Activate smoke-control system (smoke management) at firefighters' smoke-control system panel.
- 9) Activate stairwell and elevator-shaft pressurization systems.
- 10) Close smoke dampers in air ducts of designated air-conditioning duct systems.
- 11) Activate preaction system.
- 12) Recall elevators to primary or alternate recall floors.
- 13) Activate elevator power shunt trip.
- 14) Activate emergency lighting control.
- 15) Activate emergency shutoffs for gas and fuel supplies, **except for shutoffs serving legally required life-safety systems such as emergency generators and fire pumps.**
- 16) Record events in system memory.
- 17) Record events by system printer.
- 18) Indicate device in alarm on graphic annunciator.

d. Supervisory signal initiation must be by one or more of the following devices and actions:

- 1) Valve supervisory switch.
- 2) High- or low-air-pressure switch of dry-pipe or preaction sprinkler system.
- 3) Alert and Action signals of air-sampling detector system.
- 4) Elevator shunt-trip supervision.
- 5) Independent fire-detection and -suppression systems.
- 6) Fire pump is running.
- 7) Fire pump has lost power.
- 8) Power to fire pump has phase reversal.
- 9) Zones or individual devices have been disabled.
- 10) FACU has lost communication with network.

e. System trouble signal initiation must be by one or more of the following devices and actions:

- 1) Open circuits, shorts, and grounds in designated circuits.
- 2) Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.

- 3) Loss of communication with addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
 - 4) Loss of primary power at FACU.
 - 5) Ground or single break in internal circuits of FACU.
 - 6) Abnormal ac voltage at FACU.
 - 7) Break in standby battery circuitry.
 - 8) Failure of battery charging.
 - 9) Abnormal position of switch at FACU or annunciator.
 - 10) Voice signal amplifier failure.
 - 11) Hose cabinet door open.
- f. System Supervisory Signal Actions:
- 1) Initiate notification appliances.
 - 2) Identify specific device initiating event at FACU, **connected network control panels, off-premises network control panels, and remote annunciators.**
 - 3) Record event on system printer.
 - 4) After time delay of **200 seconds**, transmit trouble or supervisory signal to remote alarm receiving station.
 - 5) Transmit system status to building management system.
 - 6) Display system status on graphic annunciator.
- g. Network Communications:
- 1) Provide network communications for fire-alarm system in accordance with fire-alarm manufacturer's written instructions.
 - 2) Provide network communications pathway per manufacturer's written instructions and requirements in NFPA 72 and NFPA 70.
 - 3) Provide integration gateway using either **BACnet** or **Modbus** for connection to building automation system.
- h. System Printer:
- 1) Printer must be listed and labeled as integral part of fire-alarm system.
- i. Device Guards:
- 1) Description: Welded wire mesh of size and shape for manual station, smoke detector, gong, or other device requiring protection.
 - a) Factory fabricated and furnished by device manufacturer.
 - b) Finish: Paint of color to match protected device.
- j. Document Storage Box:
- 1) Description: Enclosure to accommodate standard 8-1/2-by-11 inch manuals and loose document records. Legend sheet will be permanently attached to door for system required documentation, key contacts, and system information. Provide two key ring holders with location to mount standard business cards for key contact personnel.
 - 2) Material and Finish: 18-gauge cold-rolled steel; four mounting holes.
 - 3) Color: Red powder-coat epoxy finish.
 - 4) Labeling: Permanently screened with 1 inch high lettering "SYSTEM RECORD DOCUMENTS" with white indelible ink.

- 5) Security: Locked with 3/4 inch barrel lock. Provide solid 12 inch stainless steel piano hinge.

2.03 FIRE-ALARM CONTROL UNIT (FACU)

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include devices and components that shall be manufactured by the existing system or UL listed to function with the existing system.
- B. Description: Field-programmable, microprocessor-based, modular, power-limited design with electronic modules.
- C. Performance Criteria:
 1. Regulatory Requirements: Comply with NFPA 72 and UL 864.
 2. General Characteristics:
 - a. System software and programs must be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining information through failure of primary and secondary power supplies.
 - b. Include real-time clock for time annotation of events on event recorder and printer.
 - c. Provide communication between FACU and remote circuit interface panels, annunciators, and displays.
 - d. FACU must be listed for connection to central-station signaling system service.
 - e. Provide nonvolatile memory for system database, logic, and operating system and event history. System must require no manual input to initialize in the event of complete power down condition. FACU must provide minimum 500-event history log.
 - f. Addressable Initiation Device Circuits: FACU must indicate which communication zones have been silenced and must provide selective silencing of alarm notification appliance by building communication zone.
 - 1) Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: FACU must be listed for releasing service.
 - g. Fire-Alarm Annunciator: Arranged for interface between human operator at FACU and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and programming and control menu.
 - 1) Annunciator and Display: LCD, **80** characters, minimum.
 - 2) Keypad: Arranged to permit entry and execution of programming, display, and control commands.
 - h. Alphanumeric Display and System Controls: Arranged for interface between human operator at FACU and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and programming and control menu.
 - 1) Annunciator and Display: LCD, **three** line(s) of **80** characters, minimum.
 - 2) Keypad: Arranged to permit entry and execution of programming, display, and control commands **and to indicate control commands to be entered into system for control of smoke-detector sensitivity and other parameters.**

- i. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
 - 1) Pathway Class Designations: NFPA 72, **Class A**, **Class B**, **Class C**, **Class D**, or **Class E** as indicated on Drawings.
 - 2) Pathway Survivability: **Level 0** or **Level 1**, as indicated on Drawings.
 - 3) Install no more than **256** addressable devices on each signaling-line circuit.
 - 4) Install fault circuit isolators to comply with circuit performance requirements of NFPA 72 or with manufacturer's written instructions, whichever is more conservative.
- j. Serial Interfaces:
 - 1) One dedicated RS 485 port for **central-station** and/or **remote station**, as indicated on Drawings, operation using point ID DACT.
 - 2) One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
 - 3) One **USB** or **RS 232** port for PC configuration.
 - 4) One RS 232 port for air-aspirating smoke detector connection.
 - 5) One RS 232 port for voice evacuation interface.
- k. Stairwell and Elevator Shaft Pressurization: Provide output signal using addressable relay to start stairwell and elevator shaft pressurization system. Signal must remain on until alarm conditions are cleared and fire-alarm system is reset. Signal must not stop in response to alarm acknowledge or signal silence commands.
 - 1) Pressurization starts when alarm is received at FACU.
 - 2) Alarm signals from smoke detectors at pressurization air supplies have higher priority than other alarm signals that start system.
- l. Smoke-Alarm Verification:
 - 1) Initiate audible and visible indication of "alarm-verification" signal at FACU.
 - 2) Activate approved "alarm-verification" sequence at FACU and detector.
 - 3) Record events by system printer.
 - 4) Sound general alarm if alarm is verified.
 - 5) Cancel FACU indication and system reset if alarm is not verified.
- m. Notification-Appliance Circuit:
 - 1) Audible appliances must sound in three-pulse temporal pattern, as defined in NFPA 72.
 - 2) Where notification appliances provide signals to sleeping areas, alarm signal must be 520 Hz square wave with intensity 15 dB above average ambient sound level or 5 dB above maximum sound level, or at least 75 dB(A-weighted), whichever is greater, measured at pillow.
 - 3) Visual alarm appliances must flash in synchronization where multiple appliances are in same field of view, as defined in NFPA 72.
- n. Elevator Recall: Initiate by one of the following alarm-initiating devices:
 - 1) Elevator lobby detectors except lobby detector on designated floor.
 - 2) Smoke detectors in elevator machine room.
 - 3) Smoke detectors in elevator hoistway.

- o. Elevator controller must be programmed to move cars to alternate recall floor if lobby detectors located on designated recall floors are activated.
- p. Water-flow alarm connected to sprinkler in elevator shaft and elevator machine room must shut down elevators associated with location without time delay.
 - 1) Water-flow switch associated with sprinkler in elevator pit may have delay to allow elevators to move to designated floor.
- q. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls must **not** be connected to fire-alarm system.
- r. Remote Smoke-Detector Sensitivity Adjustment: Controls must select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out final adjusted values on system printer.
- s. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to remote alarm station.
- t. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided **in either a separate cabinet located in fire command center or as a special module that is part of FACU.**
- u. Indicate number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of central-control microphone. Amplifiers must comply with UL 1711.
 - 1) Allow application of, and evacuation signal to, indicated number of zones and simultaneously allow voice paging to other zones selectively or in combination.
 - 2) Programmable tone and message sequence selection.
 - 3) Standard digitally recorded messages for "Evacuation" and "All Clear."
 - 4) Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification-appliance circuits of FACU.
- v. Status Annunciator: Indicate status of various voice/alarm speaker zones and status of firefighters' two-way telephone communication zones.
- w. Preamplifiers, amplifiers, and tone generators must automatically transfer to backup units, on primary equipment failure.
- x. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from other printed indications. Also, print system reset event, including same information for device, location, date, and time. Commands initiate printing of list of existing alarm, supervisory, and trouble conditions in system and historical log of events.
- y. Primary Power: 24 V(dc) obtained from 120 V(ac) service and power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, **and supervisory signals, supervisory and DACT, and digital alarm radio transmitters** must be powered by 24 V(dc) source.
- z. Alarm current draw of entire fire-alarm system must not exceed 80 percent of power-supply module rating.
- aa. Secondary Power: 24 V(dc) supply system with batteries, automatic battery charger, and automatic transfer switch.

- bb. Batteries: **Sealed lead calcium, Sealed, valve-regulated, recombinant lead acid, or Vented, wet-cell pocket, plate nickel cadmium**, as provided by selected manufacturer.

D. Accessories:

1. Instructions: Computer printout or typewritten instruction card mounted behind plastic or glass cover in stainless steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe functional operation of system under normal, alarm, and trouble conditions.
2. Preaction System Functionality:
 - a. Initiate Presignal Alarm: This function must cause audible and visual alarm and indication to be provided at FACU. Activation of initiation device connected as part of preaction system must be annunciated at FACU only, without activation of general evacuation alarm.

2.04 MANUAL FIRE-ALARM BOXES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include devices and components that shall be manufactured by the existing system or UL listed to function with the existing system.
- B. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes must be finished in red with molded, raised-letter operating instructions in contrasting color; must show visible indication of operation; and must be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 1. Single-action mechanism, **breaking-glass, plastic-rod, or pull-lever** type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to FACU.
 2. Double-action mechanism requiring two actions to initiate alarm, **breaking-glass, plastic-rod, or pull-lever** type; with **integral or attached** addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to FACU.
 3. Station Reset: Key- or wrench-operated switch.
 4. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at top to permit lifting for access to initiate alarm. Lifting cover actuates integral battery-powered audible horn intended to discourage false-alarm operation.
 5. Weatherproof Protective Shield: Factory-fabricated, clear plastic enclosure hinged at top to permit lifting for access to initiate alarm.
 6. Able to perform at up to **90** percent relative humidity at **110 deg F**.
 7. Material: Manual stations made of **Lexan polycarbonate**.
 8. Able to be used in **indoor or outdoor** areas, as required by Drawings.

2.05 SYSTEM SMOKE DETECTORS

- A. Photoelectric Smoke Detectors:
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include devices and components that shall be manufactured by the existing system or UL listed to function with the existing system

2. Performance Criteria:

a. Regulatory Requirements:

- 1) NFPA 72.
- 2) UL 268.

b. General Characteristics:

- 1) Detectors must be **four** or **two**-wire type.
- 2) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
- 3) Base Mounting: Detector and associated electronic components must be mounted in twist-lock module that connects to fixed base. Provide terminals in fixed base for connection to building wiring.
- 4) Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
- 5) Integral Visual-Indicating Light: LED type, indicating detector has operated **and power-on status**.
- 6) Detector address must be accessible from FACU and must be able to identify detector's location within system and its sensitivity setting.
- 7) Operator at FACU, having designated access level, must be able to manually access the following for each detector:
 - a) Primary status.
 - b) Device type.
 - c) Present average value.
 - d) Present sensitivity selected.
 - e) Sensor range (normal, dirty, etc.).
- 8) Detector must have functional humidity range within **10 to 90** percent relative humidity.
- 9) Color: **White**.
- 10) Remote Control: Unless otherwise indicated, detectors must be digital-addressable type, individually monitored at FACU for calibration, sensitivity, and alarm condition **and individually adjustable for sensitivity by FACU**.
- 11) Rate-of-rise temperature characteristic of combination smoke- and heat-detection units must be selectable at FACU for 15 or 20 deg F per minute.
- 12) Fixed-temperature sensing characteristic of combination smoke- and heat-detection units must be independent of rate-of-rise sensing and must be settable at FACU to operate at 135 or 155 deg F.
- 13) Multiple levels of detection sensitivity for each sensor.
- 14) Sensitivity levels based on time of day.

B. Ionization Smoke Detectors:

1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include devices and components that shall be manufactured by the existing system or UL listed to function with the existing system.
2. Performance Criteria:
 - a. Regulatory Requirements:

- 1) NFPA 72.
- 2) UL 268.

b. General Characteristics:

- 1) Detectors must be **four** or **two**-wire type.
- 2) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
- 3) Base Mounting: Detector and associated electronic components must be mounted in twist-lock module that connects to fixed base. Provide terminals in fixed base for connection to building wiring.
- 4) Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
- 5) Integral Visual-Indicating Light: LED type, indicating detector has operated **and power-on status**.
- 6) Detector address must be accessible from FACU and must be able to identify detector's location within system and its sensitivity setting.
- 7) Operator at FACU, having designated access level, must be able to manually access the following for each detector:
 - a) Primary status.
 - b) Device type.
 - c) Present average value.
 - d) Present sensitivity selected.
 - e) Sensor range (normal, dirty, etc.).
- 8) Detector must have functional humidity range within **10 to 90** percent relative humidity.
- 9) Color: **White**.
- 10) Remote Control: Unless otherwise indicated, detectors must be digital-addressable type, individually monitored at FACU for calibration, sensitivity, and alarm condition **and individually adjustable for sensitivity by FACU**.
- 11) Rate-of-rise temperature characteristic of combination smoke- and heat-detection units must be selectable at FACU for 15 or 20 deg F per minute.
- 12) Fixed-temperature sensing characteristic of combination smoke- and heat-detection units must be independent of rate-of-rise sensing and must be settable at FACU to operate at 135 or 155 deg F.
- 13) Multiple levels of detection sensitivity for each sensor.
- 14) Sensitivity levels based on time of day.

2.06 DUCT SMOKE DETECTORS

- A. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include devices and components that shall be manufactured by the existing system or UL listed to function with the existing system.
- B. Description: Photoelectric-type, duct-mounted smoke detector.
- C. Performance Criteria:
 1. Regulatory Requirements:
 - a. NFPA 72.
 - b. UL 268A.

2. General Characteristics:

- a. Detectors must be **four** or **two-wire** type.
- b. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
- c. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
- d. Integral Visual-Indicating Light: LED type, indicating detector has operated **and power-on status**.
- e. Detector address must be accessible from FACU and must be able to identify detector's location within system and its sensitivity setting.
- f. Operator at FACU, having designated access level, must be able to manually access the following for each detector:
 - 1) Primary status.
 - 2) Device type.
 - 3) Present average value.
 - 4) Present sensitivity selected.
 - 5) Sensor range (normal, dirty, etc.).
- g. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with supplied detector for smoke detection in HVAC system ducts.
- h. Each sensor must have multiple levels of detection sensitivity.
- i. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
- j. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

2.07 CARBON MONOXIDE DETECTORS

- A. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include devices and components that shall be manufactured by the existing system or UL listed to function with the existing system.
- B. Description: Carbon monoxide detector listed for connection to fire-alarm system.
- C. Performance Criteria:
 - 1. Regulatory Requirements:
 - a. NFPA 72
 - b. NFPA 720.
 - c. UL 2075.
 - 2. General Characteristics:
 - a. Mounting: Adapter plate for outlet box mounting.
 - b. Testable by introducing test carbon monoxide into sensing cell.
 - c. Detector must provide alarm contacts and trouble contacts.
 - d. Detector must send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
 - e. Locate, mount, and wire in accordance with manufacturer's written instructions.
 - f. Provide means for addressable connection to fire-alarm system.
 - g. Test button simulates alarm condition.

2.08 HEAT DETECTORS

A. Combination-Type Heat Detectors:

1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include devices and components that shall be manufactured by the existing system or UL listed to function with the existing system.
2. Performance Criteria:
 - a. Regulatory Requirements:
 - 1) NFPA 72.
 - 2) UL 521.
 - b. General Characteristics:
 - 1) Temperature sensors must test for and communicate sensitivity range of device.
 - c. Actuated by fixed temperature of **135 deg F** or rate of rise that exceeds **15 deg F** per minute unless otherwise indicated.
 - d. Mounting: Either **Adapter plate for outlet box mounting** or **Twist-lock base interchangeable with smoke-detector bases**.
 - e. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
 - f. Detector must have functional humidity range of **10 to 90** percent relative humidity.
 - g. Color: **White**.

B. Fixed-Temperature-Type Heat Detectors:

1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include devices and components that shall be manufactured by the existing system or UL listed to function with the existing system.
2. Performance Criteria:
 - a. Regulatory Requirements:
 - 1) NFPA 72.
 - 2) UL 521.
 - b. General Characteristics:
 - 1) Actuated by temperature that exceeds fixed temperature of **190 deg F**.
 - 2) Mounting: Either **Adapter plate for outlet box mounting** or **Twist-lock base interchangeable with smoke-detector bases**.
 - 3) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
 - 4) Detector must have functional humidity range of **10 to 90** percent.
 - 5) Color: **White**.

2.09 MULTICRITERIA AND MULTISENSOR FIRE DETECTORS

- A. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include devices and components that shall be manufactured by the existing system or UL listed to function with the existing system.
- B. Description: Fire-sensing detectors using multiple means of detection.
- C. Performance Criteria:
 - 1. Regulatory Requirements:
 - a. NFPA 72.
 - 2. General Characteristics:
 - a. Mounting: Either **Adapter plate for outlet box mounting** or **Twist-lock base interchangeable with smoke-detector bases**.
 - b. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
 - c. Automatically adjusts its sensitivity by means of drift compensation and smoothing algorithms. Detector must send trouble alarm if it is incapable of compensating for existing conditions.
 - d. Test button tests sensors in detector.
 - e. Operator at FACU, having designated access level, must be able to manually access the following for each detector:
 - 1) Primary status.
 - 2) Device type.
 - 3) Present sensitivity selected.
 - 4) Sensor range (normal, dirty, etc.).
 - f. Detector must have functional humidity range within **10 to 90** percent relative humidity.
 - g. Color: **White**.
 - h. Comply with **UL and FM Global** requirements.
 - i. Sensors (Multisensor Type): Detector must be comprised of four sensing elements including smoke sensor, carbon monoxide sensor, infrared sensor, and heat sensor.
 - 1) Smoke sensor must be photoelectric type as described in "System Smoke Detectors" Article.
 - 2) Carbon monoxide sensor must be as described in "Carbon Monoxide Detectors" Article.
 - 3) Heat sensor must be as described in "Heat Detectors" Article.
 - 4) Each sensor must be separately listed in accordance with requirements for its detector type.

2.10 FIRE-ALARM NOTIFICATION APPLIANCES

- A. Fire-Alarm Audible Notification Appliances:
 - 1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include devices and

components that shall be manufactured by the existing system or UL listed to function with the existing system.

2. Description: Horns, bells, or other notification devices that cannot output voice messages.
3. Performance Criteria:

a. Regulatory Requirements:

- 1) NFPA 72.

b. General Characteristics:

- 1) Individually addressed, connected to signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.
- 2) Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
- 3) Chimes, Low-Level Output: Vibrating type, 75 dB(A-weighted) minimum rated output.
- 4) Chimes, High-Level Output: Vibrating type, 81 dB(A-weighted) minimum rated output.
- 5) Sounders, High Volume 24 V(dc): **Less than 6 mA** of alarm current.
- 6) Sounders, Low Volume 24 V(dc): **Less than 4 mA** of alarm current.
- 7) Audible notification appliances must have functional humidity range of **10 to 95** percent relative humidity.
- 8) ISO Temporal 3 Evacuation Tone: **90 plus or minus 4 dB(A-weighted)** at 24 V.
- 9) ISO Temporal 3 Alert Tone: **95 plus or minus 5 dB(A-weighted)** at 24 V.
- 10) AS2220 Evacuation Tone: **93 plus or minus 4 dB(A-weighted)** at 24 V.
- 11) AS2220 Alert Tone: **93 plus or minus 5 dB(A-weighted)** at 24 V.
- 12) Horns: Electric-vibrating-polarized type, 24 V(dc); with provision for housing operating mechanism behind grille. Comply with UL 464. Horns must produce sound-pressure level of 90 dB(A-weighted), measured 10 ft. from horn, using coded signal prescribed in UL 464 test protocol.
- 13) Combination Devices: Factory-integrated audible and visible devices in single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

B. Fire-Alarm Voice/Tone Notification Appliances:

1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include devices and components that shall be manufactured by the existing system or UL listed to function with the existing system.

2. Description: Notification appliances capable of outputting voice evacuation messages.
3. Performance Criteria:

a. Regulatory Requirements:

- 1) NFPA 72.
- 2) UL 1480.

b. General Characteristics:

- 1) Speakers for Voice Notification: Locate speakers for voice notification to provide intelligibility requirements of "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
- 2) High-Range Units: Rated 2 to 15 W.
- 3) Low-Range Units: Rated 1 to 2 W.
- 4) Mounting: **Flush, semi-recessed, or surface mounted and bidirectional**, as indicated on Drawings.
- 5) Matching Transformers: Tap range matched to acoustical environment of speaker location.
- 6) Combination Devices: Factory-integrated audible and visible devices in single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

C. Fire-Alarm Visible Notification Appliances:

1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include devices and components that shall be manufactured by the existing system or UL listed to function with the existing system.
2. Performance Criteria:
 - a. Regulatory Requirements:
 - 1) NFPA 72.
 - 2) UL 1971.
 - b. General Characteristics:
 - 1) Rated Light Output:
 - a) **75** cd.
 - b) 15/30/75/110 cd, selectable in field.
 - 2) Clear or nominal white polycarbonate lens mounted on aluminum faceplate.
 - 3) Mounting: Wall mounted unless otherwise indicated.
 - 4) For units with guards to prevent physical damage, light output ratings must be determined with guards in place.
 - 5) Flashing must be in temporal pattern, synchronized with other units.
 - 6) Strobe Leads: Factory connected to screw terminals.
 - 7) Mounting Faceplate: Factory finished, **red**.

2.11 FIRE-ALARM REMOTE ANNUNCIATORS; maintain existing equipment

2.12 FIRE-ALARM ADDRESSABLE INTERFACE DEVICES

- A. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include devices and components that shall be manufactured by the existing system or UL listed to function with the existing system.
- B. Performance Criteria:
 1. Regulatory Requirements:

- a. NFPA 72.
 - 2. General Characteristics:
 - a. Include address-setting means on module.
 - b. Store internal identifying code for control panel use to identify module type.
 - c. Listed for controlling HVAC fan motor controllers.
 - d. Monitor Module: Microelectronic module providing system address for alarm-initiating devices for wired applications with normally open contacts.
 - e. Integral Relay: Capable of providing direct signal **to elevator controller to initiate elevator recall and to circuit-breaker shunt trip for power shutdown.**
 - 1) Allow control panel to switch relay contacts on command.
 - 2) Have minimum of two normally open and two normally closed contacts available for field wiring.
 - f. Control Module:
 - 1) Operate notification devices.
 - 2) Operate solenoids for use in sprinkler service.
- 2.13 DIGITAL ALARM COMMUNICATOR TRANSMITTERS (DACTs); maintain existing equipment**
- 2.14 FIRE-ALARM RADIO TRANSMITTERS; maintain existing equipment**

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
 - 1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Preinstallation Testing: Perform verification of functionality of installed components of existing system prior to starting work. Document 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 in accordance with requirements indicated:

1. Notify **Architect** and **Construction Manager** 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. Protection of In-Place Conditions: Protect devices during construction unless devices are placed in service to protect facility during construction.

3.03 INSTALLATION OF EQUIPMENT

- A. Comply with NECA 305, NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
1. Devices placed in service before other trades have completed cleanup must be replaced.
 2. Devices installed, but not yet placed, in service must be protected from construction dust, debris, dirt, moisture, and damage in accordance with manufacturer's written storage instructions.
- B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
1. Connect new equipment to existing control panel in existing part of building.
 2. Connect new equipment to existing monitoring equipment at supervising station.
 3. Expand, modify, and supplement existing **control** and **monitoring** equipment as necessary to extend existing **control** and **monitoring** functions to new points. New components must be capable of merging with existing configuration without degrading performance of either system.
- C. Equipment Floor Mounting: Install FACU on concrete base. Comply with requirements for concrete base specified in Section 03 30 00 "Cast-in-Place Concrete."
1. Install seismic bracing. Comply with requirements in Section 27 05 48.16 "Seismic Controls for Communications Systems."
 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18 inch centers around full perimeter of concrete base.
 3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
- D. Equipment Floor and Wall Mounting: Install FACU on finished floor.
1. Comply with requirements for seismic-restraint devices specified in Section 27 05 48.16 "Seismic Controls for Communications Systems."
- E. Install wall-mounted equipment, with tops of cabinets not more than 78 inch above finished floor.
1. Comply with requirements for seismic-restraint devices specified in Section 27 05 48.16 "Seismic Controls for Communications Systems."
- F. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in normal path of egress within 60 inch of exit doorway.
 2. Mount manual fire-alarm box on background of contrasting color.
 3. Operable part of manual fire-alarm box must be between 42 and 48 inch above floor level. Devices must be mounted at same height unless otherwise indicated.
- G. Smoke- and Heat-Detector Spacing:
1. Comply with "Smoke-Sensing Fire Detectors" section in "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
 2. Comply with "Heat-Sensing Fire Detectors" section in "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
 3. Smooth ceiling spacing must not exceed **30 ft.**
 4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas must be determined in accordance with Annex A **or Annex B** in NFPA 72.
 5. HVAC: Locate detectors not closer than **36 inch** from air-supply diffuser or return-air opening.
 6. Lighting Fixtures: Locate detectors not closer than 12 inch from lighting fixture and not directly above pendant mounted or indirect lighting.
- H. Install cover on each smoke detector that is not placed in service during construction. Cover must remain in place except during system testing. Remove cover prior to system turnover.
- I. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend full width of duct. Tubes more than 36 inch long must be supported at both ends.
1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.
- J. Air-Sampling Smoke Detectors: If using multiple pipe runs, runs must be pneumatically balanced.
- K. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.
- L. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within dwelling or suite, they must be connected so that operation of smoke alarm causes alarm in smoke alarms to sound.
- M. Remote Status and Alarm Indicators: Install in visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.
- N. Audible Alarm-Indicating Devices: Install not less than 6 inch below ceiling. Install bells and horns on flush-mounted back boxes with device-operating mechanism concealed behind grille. Install devices at same height unless otherwise indicated.
- O. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inch below ceiling. Install devices at same height unless otherwise indicated.
- P. Device Location-Indicating Lights: Locate in public space near device they monitor.
- Q. Antenna for Radio Alarm Transmitter: Mount to building structure where indicated. Use mounting arrangement and substrate connection that resists wind load of **100 mph** with gust factor of 1.3 without damage.

3.04 ELECTRICAL CONNECTIONS

- A. Connect wiring in accordance with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment in accordance with Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate must be laminated acrylic or melamine plastic signs, as specified in Section 26 05 53 "Identification for Electrical Systems."
 - 2. Nameplate must be laminated acrylic or melamine plastic signs with black background and engraved white letters at least **1/2 inch** high.

3.05 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring in accordance with Section 26 05 23 "Control-Voltage Electrical Power Cables."
- C. Install nameplate for each control connection, indicating field control panel designation and I/O control designation feeding connection.

3.06 PATHWAYS

- A. Pathways above recessed ceilings and in inaccessible locations may be routed exposed.
 - 1. Exposed pathways located less than 96 inch above floor must be installed in EMT.
- B. Pathways must be installed in EMT.
- C. Exposed EMT must be painted red enamel.

3.07 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 08 71 00 "Door Hardware." Connect hardware and devices to fire-alarm system.
 - 1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.
- B. Make addressable connections with supervised interface device to the following devices and systems. Install interface device less than 36 inch from device controlled. Make addressable confirmation connection when such feedback is available at device or system being controlled.

1. Alarm-initiating connection to smoke-control system (smoke management) at firefighters' smoke-control system panel.
2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
3. Smoke dampers in air ducts of designated HVAC duct systems.
4. Magnetically held-open doors.
5. Electronically locked doors and access gates.
6. Alarm-initiating connection to elevator recall system and components.
7. Alarm-initiating connection to activate emergency lighting control.
8. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
9. Supervisory connections at valve supervisory switches.
10. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
11. Supervisory connections at elevator shunt-trip breaker.
12. Data communication circuits for connection to building management system.
13. Data communication circuits for connection to mass notification system.
14. Supervisory connections at fire-extinguisher locations.
15. Supervisory connections at fire-pump power failure including dead-phase or phase-reversal condition.
16. Supervisory connections at fire-pump engine control panel.

3.08 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 27 05 53 "Identification for Communications Systems."
- B. Install framed instructions in location visible from FACU.

3.09 GROUNDING

- A. Ground FACU and associated circuits in accordance with Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- B. Ground shielded cables at control panel location only. Insulate shield at device location.

3.10 FIELD QUALITY CONTROL

- A. Field tests must be witnessed by **authorities having jurisdiction**.
- B. Administrant for Tests and Inspections:
 1. Owner will engage qualified testing agency to administer and perform tests and inspections.
 2. Engage qualified testing agency to administer and perform tests and inspections.
 3. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
 4. Administer and perform tests and inspections.
- C. Tests and Inspections:
 1. Visual Inspection: Conduct visual inspection prior to testing.

- a. Inspection must be based on completed record Drawings and system documentation that is required by "Completion Documents, Preparation" table in "Documentation" section of "Fundamentals" chapter in NFPA 72.
 - b. Comply with "Visual Inspection Frequencies" table in "Inspection" section of "Inspection, Testing and Maintenance" chapter in NFPA 72; retain "Initial/Reacceptance" column and list only installed components.
2. System Testing: Comply with "Test Methods" table in "Testing" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.
 3. Test audible appliances for public operating mode in accordance with manufacturer's written instructions. Perform test using portable sound-level meter complying with Type 2 requirements in ASA S1.4 Part 1/IEC 61672-1.
 4. Test audible appliances for private operating mode in accordance with manufacturer's written instructions.
 5. Test visible appliances for public operating mode in accordance with manufacturer's written instructions.
 6. Factory-authorized service representative must prepare "Fire Alarm System Record of Completion" in "Documentation" section of "Fundamentals" chapter in NFPA 72 and "Inspection and Testing Form" in "Records" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.
- D. Reacceptance Testing: Perform reacceptance testing to verify proper operation of added or replaced devices and appliances.
- E. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.
- G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- H. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.11 DEMONSTRATION

- A. **Train** Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system. **Provide video recording of training to Owner and allow Owner to record training.**

3.12 MAINTENANCE

- A. Maintenance Service: Beginning at Substantial Completion, maintenance service must include **12 months'** full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies must be manufacturer's authorized replacement parts and supplies.
1. Include visual inspections in accordance with "Visual Inspection Frequencies" table in "Testing" paragraph of "Inspection, Testing and Maintenance" chapter in NFPA 72.
 2. Perform tests in "Test Methods" table in "Testing" paragraph of "Inspection, Testing and Maintenance" chapter in NFPA 72.

3. Perform tests per "Testing Frequencies" table in "Testing" paragraph of "Inspection, Testing and Maintenance" chapter in NFPA 72.

3.13 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning at Substantial Completion, service agreement must include software support for **two** years.
- C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within **two** years from date of Substantial Completion. Upgrading software must include operating system and new or revised licenses for using software.
 1. Upgrade Notice: At least **30** days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

END OF SECTION

DEPARTMENT OF COMMERCE
FINANCIAL ASSISTANCE
STANDARD TERMS AND CONDITIONS



DEPARTMENT OF COMMERCE
FINANCIAL ASSISTANCE STANDARD TERMS AND CONDITIONS

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PREFACE

This document sets out the standard terms and conditions (ST&Cs) applicable to this U.S. Department of Commerce (DOC or Commerce) financial assistance award (hereinafter referred to as the DOC ST&Cs or Standard Terms). A non-Federal entity¹ receiving a DOC financial assistance award must, in addition to the assurances made as part of the application, comply and require each of its subrecipients, contractors, and subcontractors employed in the completion of the project to comply with all applicable statutes, regulations, executive orders (E.O.s), Office of Management and Budget (OMB) circulars, provisions of the OMB Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards (codified at 2 C.F.R. Part 200) (OMB Uniform Guidance), provisions of these Standard Terms, and any other terms and conditions incorporated into this DOC financial assistance award. In addition, unless otherwise provided by the terms and conditions of this DOC financial assistance award, Subparts A through E of 2 C.F.R. Part 200 and the Standard Terms are applicable to for-profit entities, foreign public entities and to foreign organizations that carry out a DOC financial assistance award.²

This award is subject to the laws and regulations of the United States. Any inconsistency or conflict in terms and conditions specified in the award will be resolved according to the following order of precedence: federal laws and regulations, applicable notices published in the *Federal Register*, E.O.s, OMB circulars, DOC ST&Cs, agency standard award conditions (if any), and specific award conditions. A specific award condition may amend or take precedence over a Standard Term on a case-by-case basis, when indicated by the specific award condition.

Some of the Standard Terms herein contain, by reference or substance, a summary of the pertinent statutes, regulations published in the *Federal Register* or Code of Federal Regulations (C.F.R.), E.O.s, OMB circulars, or the certifications and assurances provided by applicants through Standard Forms (*e.g.*, SF-424s) or through DOC forms (*e.g.* Form CD-511). To the extent that it is a summary, such Standard Term provision is not in derogation of, or an amendment to, any such statute, regulation, E.O., OMB circular, certification, or assurance.

¹ Note that the OMB Uniform Guidance uses the term “non-Federal entity” to generally refer to an entity that carries out a Federal award as a recipient or subrecipient. Because some of the provisions of these DOC ST&Cs apply to recipients rather than subrecipients, or vice versa, for clarity, these DOC ST&Cs use the terms “non-Federal entity,” “recipient,” and “subrecipient” consistent with their meanings in the OMB Uniform Guidance. In addition, the OMB Uniform Guidance uses the term “pass-through entity” to refer to a non-Federal entity that makes a subaward. As defined at 2 C.F.R. § 200.1:

“Non-Federal entity” is “a state, local government, Indian tribe, institution of higher education (IHE), or nonprofit organization that carries out a Federal award as a recipient or subrecipient.”

“Recipient” is “an entity, usually but not limited to non-Federal entities, that receives a Federal award directly from a Federal awarding agency. The term recipient does not include subrecipients or individuals that are beneficiaries of the award.”

“Subrecipient” is “an entity, usually but not limited to non-Federal entities, that receives a subaward from a pass-through entity to carry out part of a Federal award; but does not include an individual that is a beneficiary of such award. A subrecipient may also be a recipient of other Federal awards directly from a Federal awarding agency.”

“Pass-through entity” is “a non-Federal entity that provides a subaward to a subrecipient to carry out part of a Federal program.”

² See 2 C.F.R. § 200.1 for the definitions of “foreign public entity” and “foreign organization.”

DOC commenced implementation of the Research Terms and Conditions (RT&Cs) for Federal awards effective October 1, 2017; the RT&Cs address and implement the Uniform Guidance issued by OMB. For awards designated on the Form CD-450 (Financial Assistance Award) as Research, both the DOC ST&Cs and the RT&Cs as implemented by DOC apply to the award. The RT&Cs as well as the DOC implementation statement, agency specific requirements, prior approval matrix, subaward requirements, and national policy requirements are posted on the National Science Foundation's website – <https://www.nsf.gov/awards/managing/rtc.jsp>. The DOC ST&Cs and the RT&Cs are generally intended to harmonize with each other; however, where the DOC ST&Cs and the RT&Cs differ in a Research award, the RT&Cs prevail, unless otherwise indicated in a specific award condition.

A. PROGRAMMATIC REQUIREMENTS

.01 Reporting Requirements

a. Recipients must submit all reports as required by DOC, electronically or, if unable to submit electronically, in hard copy, as outlined below and as may be supplemented by the terms and conditions of a specific DOC award.

b. Performance (Technical) Reports. Recipients must submit performance (technical) reports to the Program Officer. Performance (technical) reports should be submitted in the same frequency as the Form SF-425 (Federal Financial Report), unless otherwise directed by the Grants Officer.

1. Performance (technical) reports must contain the information prescribed in 2 C.F.R. § 200.329 (Monitoring and reporting program performance), unless otherwise specified in the award conditions.

2. As appropriate and in accordance with the format provided by the Program Officer (or other OMB-approved information collections, including the Research Program Performance Report [RPPR] as adopted by DOC for use in research awards), recipients are required to relate financial data to the performance accomplishments of this Federal award. When applicable, recipients must also provide cost information to demonstrate cost effective practices (e.g., through unit cost data). The recipient's performance will be measured in a way that will help DOC to improve program outcomes, share lessons learned, and spread the adoption of best or promising practices. As described in 2 C.F.R. § 200.211 (Information contained in a Federal award), DOC will identify the timing and scope of expected performance by the recipient as related to the outcomes intended to be achieved by the Federal program.

3. Recipients (or pass-through entities as applicable) must submit a final performance report within 120 calendar days after the expiration of the period of performance. The subrecipient is required to submit its final performance report to the pass-through entity within 90 calendar days unless an extension has been granted.

c. Financial Reports. In accordance with 2 C.F.R. § 200.328 (Financial reporting), the recipient must submit a Form SF-425 (Federal Financial Report) or any successor form on a semi-annual basis for the periods ending March 31 and September 30, or any portion thereof, unless otherwise specified in a specific award condition. Reports must be submitted to DOC as directed by the Grants Officer, in accordance with the award conditions and are due no later than 30 calendar days following the end of each reporting period. Recipients (or pass-through entities as applicable) must submit a final Form SF-425 within 120 calendar days after the expiration of the period of performance. The subrecipient is required to submit its financial report to the pass-through entity within 90 calendar days unless an extension has been granted. A recipient may submit a final financial report in lieu of an interim financial report due at the end of the period of performance (*e.g.*, in lieu of submitting a financial report for the last semi-annual or other reporting under an award, a recipient may submit a final (cumulative) financial report covering the entire award period).

d. Real Property, Tangible Personal Property and Intangible Property Reports and Requests for Dispositions. Unless otherwise required by the terms and conditions of a DOC financial assistance award, where real property, tangible personal property or intangible property is acquired or improved (in the case of real property or tangible personal property), or produced or acquired (in the case of intangible property), pursuant to a DOC award, non-Federal entities are required to submit the following real property, tangible personal property and intangible property reports (as appropriate):

1. Real Property Status Reports and Requests for Dispositions: Non-Federal entities must submit reports using Form SF-429 (Real Property Status Report) or any successor form, including appropriate attachments thereto, at least annually disclosing the status of real property that is Federally-owned property or real property in which the Federal Government retains a Federal Interest, unless the Federal Interest in the real property extends 15 years or longer. In cases where the Federal Interest attached is for a period of 15 years or more, the DOC or pass-through entity, at its option, may require the non-Federal entity to report at various multi-year frequencies (*e.g.*, every two years or every three years, not to exceed a five-year reporting period; or, the DOC or pass-through entity may require annual reporting for the first three years of a Federal award and thereafter require reporting every five years). In addition, DOC or a pass-through entity may require a non-Federal entity to submit Form SF-429, with appropriate attachments, relating to a non-Federal entity's request to acquire, improve or contribute real property under a DOC financial assistance award. Non-Federal entities wishing to dispose of real property acquired or improved, in whole or in part, pursuant to a DOC award must request disposition instructions, including the submission of Form SF-429, with appropriate attachments, from the Grants Officer in accordance with the requirements set forth in 2 C.F.R. § 200.311(c). *See also* the real property standards set forth in Section C. of these Standard Terms (Property Standards).
2. Tangible Personal Property Status Reports and Requests for Dispositions: DOC or a pass-through entity may also require a non-Federal entity to submit periodic reports using Form SF-428 (Tangible Personal Property Report) or any successor form, including appropriate attachments thereto, concerning tangible personal property that is Federally-owned or tangible personal property in which the Federal Government retains an interest. In

addition, DOC or a pass-through entity may require a non-Federal entity to submit Form SF-428 in connection with a non-Federal entity's request to dispose of tangible personal property acquired under a DOC financial assistance award. Non-Federal entities wishing to dispose of tangible personal property acquired or improved, in whole or in part, pursuant to a DOC award must request disposition instructions, including the submission of Form SF-428, with appropriate attachments, from the Grants Officer in accordance with the requirements set forth in 2 C.F.R. § 200.313(e). *See also* the tangible property standards set forth in Section C. of these Standard Terms (Property Standards).

3. Intangible Property Status Reports and Requests for Dispositions: The specific requirements governing the development, reporting, and disposition of rights to intangible property, including inventions and patents resulting from DOC awards, are set forth in 37 C.F.R. Part 401, which is hereby incorporated by reference into this award. Non-Federal entities are required to submit their disclosures, elections, and requests for waiver from any requirement for substantial U.S. manufacture, electronically using the Interagency Edison extramural invention reporting system (iEdison) at www.iedison.gov. Non-Federal entities may obtain a waiver of this electronic submission requirement by providing to the Grants Officer compelling reasons for allowing the submission of paper reports. When no longer needed for the originally authorized purpose, disposition of the intangible property must occur in accordance with the provisions in 2 C.F.R. § 200.313(e). *See also* the intangible property standards set forth in Section C. of these Standard Terms (Property Standards).

e. Subawards and Executive Compensation Reports. For reporting requirements on subawards and Executive Compensation, see paragraph G.05.o of these Standard Terms (The Federal Funding Accountability and Transparency Act (FFATA) (31 U.S.C. § 6101 note)).

f. Recipient Integrity and Performance Matters. For reporting requirements pertaining to integrity and performance matters, see paragraph G.05.p of these Standard Terms (Recipient Integrity and Performance Matters (Appendix XII to 2 C.F.R. Part 200)).

g. Research Performance Progress Reports. All research awards shall submit the Research Performance Progress Report (RPPR) in accordance with instructions set forth in the following link: [RPPR Instructions](#).

.02 Revisions of Program Plans

In accordance with 2 C.F.R. § 200.308 (Revision of budget and program plans) and 2 C.F.R. § 200.407 (Prior written approval (prior approval)), the recipient must obtain prior written approval from the DOC Grants Officer for certain proposed programmatic change requests, unless otherwise provided by the terms and conditions of a DOC award. Requests for prior approval for changes to program plans must be submitted to the Federal Program Officer (or electronically for awards administered through Grants Online). Requests requiring prior DOC approval are not effective unless and until approved in writing by the DOC Grants Officer.

.03 Other Federal Awards with Similar Programmatic Activities

The recipient must immediately provide written notification to the DOC Program Officer and the DOC Grants Officer if, subsequent to receipt of the DOC award, other financial assistance is received to support or fund any portion of the scope of work incorporated into the DOC award. DOC will not pay for costs that are funded by other sources.

.04 Prohibition against Assignment by a Non-Federal Entity

A non-Federal entity must not transfer, pledge, mortgage, assign, encumber or hypothecate a DOC financial assistance award or subaward, or any rights to, interests therein or claims arising thereunder, to any party or parties, including but not limited to banks, trust companies, other financing or financial institutions, or any other public or private organizations or individuals without the express prior written approval of the DOC Grants Officer or the pass-through entity (which, in turn, may need to obtain prior approval from the DOC Grants Officer).

.05 Disclaimer Provisions

a. The United States expressly disclaims all responsibility or liability to the non-Federal entity or third persons (including but not limited to contractors) for the actions of the non-Federal entity or third persons resulting in death, bodily injury, property damages, or any other losses resulting in any way from the performance of this award or any subaward, contract, or subcontract under this award.

b. The acceptance of this award or any subaward by the non-Federal entity does not in any way constitute an agency relationship between the United States and the non-Federal entity or the non-Federal entity's contractors or subcontractors.

.06 Unsatisfactory Performance or Non-Compliance with Award Provisions

a. Failure to perform the work in accordance with the terms of the award and maintain satisfactory performance as determined by DOC may result in the imposition of additional award conditions pursuant to 2 C.F.R. § 200.208 (Specific conditions) or other appropriate enforcement action as specified in 2 C.F.R. § 200.339 (Remedies for noncompliance).

b. Failure to comply with the provisions of an award will be considered grounds for appropriate enforcement action pursuant to 2 C.F.R. § 200.339 (Remedies for noncompliance), including but not limited to: the imposition of additional award conditions in accordance with 2 C.F.R. § 200.208 (Specific conditions); temporarily withholding award payments pending the correction of the deficiency; changing the payment method to reimbursement only; the disallowance of award costs and the establishment of an accounts receivable; wholly or partially suspending or terminating an award; initiating suspension or debarment proceedings in accordance with 2 C.F.R. Parts 180 and 1326; and such other remedies as may be legally available.

c. 2 C.F.R. §§ 200.340 (Termination) through 200.343 (Effects of suspension and termination) apply to an award that is terminated prior to the end of the period of performance

due to the non-federal entity's material failure to comply with the award terms and conditions. In addition, the failure to comply with the provisions of a DOC award may adversely impact the availability of funding under other active DOC or Federal awards and may also have a negative impact on a non-Federal entity's eligibility for future DOC or Federal awards.

B. FINANCIAL REQUIREMENTS

.01 Financial Management

a. In accordance with 2 C.F.R. § 200.302(a) (Financial Management), each State must expend and account for the Federal award in accordance with State laws and procedures for expending and accounting for the State's own funds. In addition, the State's and any other non-Federal entity's financial management systems, including records documenting compliance with Federal statutes, regulations, and the terms and conditions of the Federal award, must be sufficient to permit the preparation of reports required by general and program-specific terms and conditions; and the tracing of funds to a level of expenditures adequate to establish that such funds have been used in accordance with Federal statutes, regulations, and the terms and conditions applicable to the Federal award. *See also* 2 C.F.R. § 200.450 (Lobbying) for additional management requirements to verify that Federal funds are not used for unallowable lobbying costs.

b. The financial management system of each non-Federal entity must provide all information required by 2 C.F.R. § 200.302(b). *See also* 2 C.F.R. §§ 200.334 (Retention requirements for records); 200.335 (Requests for transfer of records); 200.336 (Methods for collection, transmission and storage of information); 200.337 (Access to records); and 200.338 (Restrictions on public access to records).

.02 Award Payments

a. Consistent with 2 C.F.R. § 200.305(a) (Federal payment), for States, payments are governed by Treasury-State Cash Management Improvement Act (CMIA) agreements and default procedures codified at 31 C.F.R. Part 205 (Rules and Procedures for Efficient Federal-State Funds Transfers) and Treasury Financial Manual Volume I, 4A-2000 (Overall Disbursing Rules for All Federal Agencies).

b. Consistent with 2 C.F.R. § 200.305(b), for non-Federal entities other than States, payment methods must minimize the amount of time elapsing between the transfer of funds from the U.S. Treasury or the pass-through entity and the disbursement by the non-Federal entity.

1. The Grants Officer determines the appropriate method of payment and, unless otherwise stated in a specific award condition, the advance method of payment must be authorized. Advances must be limited to the minimum amounts needed and be timed to be in accordance with the actual, immediate cash requirements of the non-Federal entity in carrying out the purpose of the approved program or project. Unless otherwise provided by the terms and conditions of a DOC award, non-Federal entities must time advance payment requests so that Federal funds are on hand for a maximum of 30 calendar days before being disbursed by the

non-Federal entity for allowable award costs.

2. If a non-Federal entity demonstrates an unwillingness or inability to establish procedures that will minimize the time elapsing between the transfer of funds and disbursement by the non-Federal entity or if a non-Federal entity otherwise fails to continue to qualify for the advance method of payment, the Grants Officer or the pass-through entity may change the method of payment to reimbursement only.

c. Unless otherwise provided for in the award terms, payments from DOC to recipients under this award will be made using the Department of Treasury's Automated Standard Application for Payment (ASAP) system. Under the ASAP system, payments are made through preauthorized electronic funds transfers directly to the recipient's bank account, in accordance with the requirements of the Debt Collection Improvement Act of 1996. To receive payments under ASAP, recipients are required to enroll with the Department of Treasury, Financial Management Service, Regional Financial Centers, which allows them to use the on-line and Voice Response System (VRS) method of withdrawing funds from their ASAP established accounts. The following information will be required to make withdrawals under ASAP:

1. ASAP account number – the Federal award identification number found on the cover sheet of the award;
2. Agency Location Code (ALC); and
3. Region Code.

d. Recipients enrolled in the ASAP system do not need to submit a Form SF-270 (Request for Advance or Reimbursement) for payments relating to their award. Awards paid under the ASAP system will contain a specific award condition, clause, or provision describing enrollment requirements and any controls or withdrawal limits set in the ASAP system.

e. When the Form SF-270 or successor form is used to request payment, the recipient must submit the request no more than monthly, and advances must be approved for periods to cover only expenses reasonably anticipated over the next 30 calendar days. Prior to receiving payments via the Form SF-270, the recipient must complete and submit to the Grants Officer the Form SF-3881 (ACH Vendor Miscellaneous Payment Enrollment Form) or successor form along with the initial Form SF-270. Form SF-3881 enrollment must be completed before the first award payment can be made via a Form SF-270 request.

f. The Federal award identification number must be included on all payment-related correspondence, information, and forms.

g. Non-Federal entities receiving advance award payments must adhere to the depository requirements set forth in 2 C.F.R. §§ 200.305(b)(7) through (b)(11). Interest amounts up to \$500 per non-Federal entity's fiscal year may be retained by the non-Federal entity for administrative expenses.

.03 Federal and Non-Federal Sharing

a. Awards that include Federal and non-Federal sharing incorporate a budget consisting of shared allowable costs. If actual allowable costs are less than the total approved budget, the Federal and non-Federal cost shares must be calculated by applying the approved Federal and non-Federal cost share ratios to actual allowable costs. If actual allowable costs exceed the total approved budget, the Federal share must not exceed the total Federal dollar amount authorized by the award.

b. The non-Federal share, whether in cash or third-party in-kind contributions, is to be paid out at the same general rate as the Federal share. Exceptions to this requirement may be granted by the Grants Officer based on sufficient documentation demonstrating previously determined plans for, or later commitment of, cash or third-party in-kind contributions. In any case, the recipient must meet its cost share commitment as set forth in the terms and conditions of the award; failure to do so may result in the assignment of specific award conditions or other further action as specified in Standard Term A.06 (Unsatisfactory Performance or Non-Compliance with Award Provisions). The non-Federal entity must create and maintain sufficient records justifying all non-Federal sharing requirements to facilitate questions and audits; see Section D of these Standard Terms (Audits), for audit requirements. See 2 C.F.R. § 200.306 for additional requirements regarding cost sharing.

.04 Budget Changes and Transfer of Funds among Categories

a. Recipients are required to report deviations from the approved award budget and request prior written approval from DOC in accordance with 2 C.F.R. § 200.308 (Revision of budget and program plans) and 2 C.F.R. § 200.407 (Prior written approval (prior approval)). Requests for such budget changes must be submitted to the Grants Officer (or electronically for awards serviced through Grants Online) who will notify the recipient of the final determination in writing. Requests requiring prior DOC approval do not become effective unless and until approved in writing by the DOC Grants Officer.

b. In accordance with 2 C.F.R. § 200.308(f), transfers of funds by the recipient among direct cost categories are permitted for awards in which the Federal share of the project is equal to or less than the simplified acquisition threshold. For awards in which the Federal share of the project exceeds the simplified acquisition threshold, transfers of funds among direct cost categories must be approved in writing by the Grants Officer when the cumulative amount of such direct costs transfers exceeds 10 percent of the total budget as last approved by the Grants Officer. The 10 percent threshold applies to the total Federal and non-Federal funds authorized by the Grants Officer at the time of the transfer request. This is the accumulated amount of Federal funding obligated to date by the Grants Officer along with any non-Federal share. The same requirements apply to the cumulative amount of transfer of funds among programs, functions, and activities. This transfer authority does not authorize the recipient to create new budget categories within an approved budget without Grants Officer approval. Any transfer that causes any Federal appropriation, or part thereof, to be used for an unauthorized purpose is not and will not be permitted. In addition, this provision does not prohibit the recipient from requesting Grants Officer approval for revisions to the budget. See 2 C.F.R. § 200.308 (Revision

of budget and program plans) (as applicable) for specific requirements concerning budget revisions and transfer of funds between budget categories.

.05 Program Income

Unless otherwise indicated in the award terms, program income may be used for any required cost sharing or added to the project budget, consistent with 2 C.F.R. § 200.307 (Program income).

.06 Indirect or Facilities and Administrative Costs

a. Indirect costs (or facilities and administration costs (F&A)) for major institutions of higher education and major nonprofit organizations can generally be defined as costs incurred for a common or joint purpose benefitting more than one cost objective, and not readily assignable to the cost objectives specifically benefited, without effort disproportionate to the results achieved. Indirect costs will not be allowable charges against an award unless permitted under the award and specifically included as a line item in the award's approved budget.

b. Unrecovered indirect costs, including unrecovered indirect costs on cost sharing or matching, may be included as part of cost sharing or matching as allowed under 2 C.F.R. § 200.306(c) (Cost sharing or matching) or the terms and conditions of a DOC award.

c. Cognizant Agency for Indirect (F&A) Costs. OMB established the cognizant agency concept, under which a single agency represents all others in dealing with non-Federal entities in common areas. The cognizant agency for indirect costs reviews and approves non-Federal entities' indirect cost rates. In accordance with Appendices III – VII to 2 C.F.R. Part 200 the cognizant agency for indirect costs reviews and approves non-Federal entities' indirect cost rates. With respect to for-profit organizations, the term cognizant Federal agency generally is defined as the agency that provides the largest dollar amount of negotiated contracts, including options. See 48 C.F.R. § 42.003. If the only Federal funds received by a commercial organization are DOC award funds, then DOC becomes the cognizant Federal agency for indirect cost negotiations.

1. General Review Procedures Where DOC is the Cognizant Agency.

i. Within 90 calendar days of the award start date, the recipient must submit to the Grants Officer any documentation (indirect cost proposal, cost allocation plan, etc.) necessary to allow DOC to perform the indirect cost rate proposal review. Below are two sources available for guidance on how to put an indirect cost plan together:

- (A) Department of Labor: <https://www.dol.gov/oasam/boc/dcd/np-comm-guide.htm>
or
- (B) Department of the Interior: <https://www.doi.gov/ibc/services/finance/indirect-Cost-Services/>.

ii. The recipient may use the rate proposed in the indirect cost plan as a provisional rate until the DOC provides a response to the submitted plan.

- iii. The recipient is required to annually submit indirect cost proposals no later than six months after the recipient's fiscal year end, except as otherwise provided by 2 C.F.R. § 200.414(g).
2. When DOC is not the oversight or cognizant Federal agency, the recipient must provide the Grants Officer with a copy of a negotiated rate agreement or a copy of the transmittal letter submitted to the cognizant or oversight Federal agency requesting a negotiated rate agreement within 30 calendar days of receipt of a negotiated rate agreement or submission of a negotiated rate proposal.
3. If the recipient is proposing indirect costs as part of a project budget, but is not required to have a negotiated rate agreement pursuant to 2 C.F.R. Part 200, Appendix VII, Paragraph D.1.b (*i.e.*, a governmental department or agency that receives \$35 million or less in direct Federal funding), the recipient may be required to provide the Grants Officer with a copy of its Certificate of Indirect Costs as referenced in 2 C.F.R. Part 200, Appendix VII, Paragraph D.3. or such other documentation, acceptable in form and substance to the Grants Officer, sufficient to confirm that proposed indirect costs are calculated and supported by documentation in accordance with 2 C.F.R. Part 200, Appendix VII. In cases where the DOC is the recipient's cognizant Federal agency, the DOC reserves the right, pursuant to 2 C.F.R. Part 200, Appendix VII, Paragraph D.1.b, to require the recipient to submit its indirect cost rate proposal for review by DOC.
- d. If the recipient fails to submit required documentation to DOC within 90 calendar days of the award start date, the Grants Officer may amend the award to preclude the recovery of any indirect costs under the award. If the DOC, oversight, or cognizant Federal agency determines there is a finding of good and sufficient cause to excuse the recipient's delay in submitting the documentation, an extension of the 90-day due date may be approved by the Grants Officer.
- e. The maximum dollar amount of allocable indirect costs for which DOC will reimburse the recipient is the lesser of:
 1. The line item amount for the Federal share of indirect costs contained in the approved award budget, including all budget revisions approved in writing by the Grants Officer; or
 2. The Federal share of the total indirect costs allocable to the award based on the indirect cost rate approved by the cognizant agency for indirect costs and applicable to the period in which the cost was incurred, in accordance with 2 C.F.R. 200 Appendix III, C.7, provided that the rate is approved on or before the award end date.
- f. In accordance with 2 CFR § 200.414(c)(3), DOC set forth policies, procedures, and general decision-making criteria for deviations from negotiated indirect cost rates. These policies and procedures are applicable to all Federal financial assistance programs awarded and administered by DOC bureaus as Federal awarding agencies and may be found at http://www.osec.doc.gov/oam/grants_management/policy/documents/FAM%202015-02.pdf.

g. In accordance with 2 CFR § 200.414(g), any non-Federal entity that has a negotiated indirect cost rate may apply to the entity's cognizant agency for indirect costs for a one-time extension of a currently negotiated indirect cost rate for a period of up to four years, reducing the frequency of rate calculations and negotiations between an institution and its cognizant agency.

h. In accordance with 2 CFR § 200.414(f), any non-Federal entity that does not have a current negotiated (including provisional) rate, except for those non-Federal entities described in paragraph D.1.b of Appendix VII to 2 CFR Part 200, may elect to charge a de minimis rate of 10 percent of modified total direct costs. No documentation is required to justify the 10 percent de minimis indirect cost rate.

.07 Incurring Costs or Obligating Federal Funds Before and After the Period of Performance

a. In accordance with 2 C.F.R. § 200.309 (Modifications to Period of Performance) and the terms and conditions of a DOC award, a non-Federal entity may charge to the Federal award only allowable costs incurred during the period of performance, which is established in the award document. As defined at 2 C.F.R. § 200.1, the "period of performance" means the total estimated time interval between the start of an initial Federal award and the planned end date, which may include one or more funded portions, or budget periods. Identification of the Period of Performance in the Federal award per § 200.211(b)(5) does not commit the awarding agency to fund the award beyond the currently approved budget period." The period of performance may sometimes be referred to as the project period or award period. This Standard Term is subject to exceptions for allowable costs pertaining to: (i) pre-award costs (*see* 2 C.F.R. § 200.458); (ii) publication and printing costs (*see* 2 C.F.R. § 200.461); and administrative costs incurred relating to the close-out of an award (*see* 2 C.F.R. § 200.344).

b. Reasonable, necessary, allowable and allocable administrative award closeout costs are authorized for a period of up to 120 calendar days following the end of the period of performance. For this purpose, award closeout costs are those strictly associated with close-out activities and are typically limited to the preparation of final progress, financial, and required project audit reports, unless otherwise approved in writing by the Grants Officer. A non-Federal entity may request an extension of the 120-day closeout period, as provided in 2 C.F.R. § 200.344 (Closeout).

c. Unless authorized by a specific award condition, any extension of the period of performance may only be authorized by the Grants Officer in writing. This is not a delegable authority. Verbal or written assurances of funding from anyone other than the Grants Officer does not constitute authority to obligate funds for programmatic activities beyond the end of the period of performance.

d. The DOC has no obligation to provide any additional prospective funding. Any amendment of the award to increase funding and to extend the period of performance is at the sole discretion of DOC.

.08 Tax Refunds

The non-Federal entity shall contact the Grants Officer immediately upon receipt of the refund of any taxes, including but not limited to Federal Insurance Contributions Act (FICA) taxes, Federal Unemployment Tax Act (FUTA) taxes, or Value Added Taxes (VAT) that were allowed as charges to a DOC award, regardless of whether such refunds are received by the non-Federal entity during or after the period of performance. The Grants Officer will provide written disposition instructions to the non-Federal entity, which may include the refunded taxes being credited to the award as either a cost reduction or a cash refund, or may allow the non-Federal entity to use such refunds for approved activities and costs under a DOC award. See 2 C.F.R. § 200.470 (Taxes (including Value Added Tax)).

.09 Internal Controls

Each recipient must comply with standards for internal controls described at 2 C.F.R. § 200.303 (Internal controls). The “Standards for Internal Control in the Federal Government” issued by the Comptroller General of the United States referenced in § 200.303 are available online at <http://www.gao.gov/assets/80/76455.pdf> and the “Internal Control Integrated Framework” issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO) is available online at [Internal Control Guidance](#).

C. PROPERTY STANDARDS

.01 Standards

Each non-Federal entity must comply with the Property Standards set forth in 2 C.F.R. §§ 200.310 (Insurance coverage) through 200.316 (Property trust relationship).

.02 Real and Personal Property

a. In accordance with 2 C.F.R. § 200.316 (Property trust relationship), real property, equipment, and other personal property acquired or improved with a Federal award must be held in trust by the non-Federal entity as trustee for the beneficiaries of the project or program under which the property was acquired or improved. This trust relationship exists throughout the duration of the property’s estimated useful life, as determined by the Grants Officer in consultation with the Program Office, during which time the Federal Government retains an undivided, equitable reversionary interest in the property (Federal Interest). During the duration of the Federal Interest, the non-Federal entity must comply with all use and disposition requirements and restrictions as set forth in 2 C.F.R. §§ 200.310 (Insurance coverage) through 200.316 (Property trust relationship), as applicable, and in the terms and conditions of the Federal award.

b. The Grants Officer may require a non-Federal entity to execute and to record (as applicable) a statement of interest, financing statement (form UCC-1), lien, mortgage or other public notice of record to indicate that real or personal property acquired or improved in whole or in part with Federal funds is subject to the Federal Interest, and that certain use and disposition

requirements apply to the property. The statement of interest, financing statement (Form UCC 1), lien, mortgage or other public notice must be acceptable in form and substance to the DOC and must be placed on record in accordance with applicable State and local law, with continuances re-filed as appropriate. In such cases, the Grants Officer may further require the non-Federal entity to provide the DOC with a written statement from a licensed attorney in the jurisdiction where the property is located, certifying that the Federal Interest has been protected, as required under the award and in accordance with applicable State and local law. The attorney's statement, along with a copy of the instrument reflecting the recordation of the Federal Interest, must be returned to the Grants Officer. Without releasing or excusing the non-Federal entity from these obligations, the non-Federal entity, by execution of the financial assistance award or by expending Federal financial assistance funds (in the case of a subrecipient), authorizes the Grants Officer and/or program office to file such notices and continuations as it determines to be necessary or convenient to disclose and protect the Federal Interest in the property. The Grants Officer may elect not to release any or a portion of the Federal award funds until the non-Federal entity has complied with this provision and any other applicable award terms or conditions, unless other arrangements satisfactory to the Grants Officer are made.

.03 Intellectual Property Rights

a. General. The rights to any work or other intangible property produced or acquired under a Federal award are determined by 2 C.F.R. § 200.315 (Intangible property). The non-Federal entity owns any work produced or purchased under a Federal award subject to the DOC's royalty-free, nonexclusive, and irrevocable right to obtain, reproduce, publish, or otherwise use the work or authorize others to receive, reproduce, publish, or otherwise use the work for Government purposes.

b. Inventions. Unless otherwise provided by law, the rights to any invention made by a non-Federal entity under a DOC financial assistance award are determined by the Bayh-Dole Act, Pub. L. No. 96-517, as amended, and as codified in 35 U.S.C. § 200 *et seq.*, and modified by E.O. 12591 (52 FR 13414), as amended by E.O. 12618 (52 FR 48661). 35 U.S.C. § 201(h) defines "small business firm" as "a small business concern as defined at section 2 of Public Law 85-536 (15 U.S.C. 632) and implementing regulations of the Administrator of the Small Business Administration." Section 1(b)(4) of E.O. 12591 extended the Bayh-Dole Act to non-Federal entities "regardless of size" to the extent permitted by law. The specific requirements governing the development, reporting, and disposition of rights to inventions and patents resulting from Federal awards are described in more detail in 37 C.F.R. Part 401, which implements 35 U.S.C. 202 through 204 and includes standard patent rights clauses in 37 C.F.R. § 401.14, which is hereby incorporated by reference into this award.

The Bayh-Dole regulations set forth in 37 C.F.R. parts 401 and 404 were amended by 83 FR 15954, with an effective date of May 14, 2018 (Amended Bayh-Dole Regulations). The Amended Bayh-Dole Regulations apply to all new financial assistance awards issued on or after May 14, 2018. The Amended Bayh-Dole Regulations do not apply to financial assistance awards issued prior to May 14, 2018, including amendments made to such awards, unless an award amendment includes a specific condition incorporating the Amended Bayh-Dole Regulations into the terms and conditions of the subject award.

1. Ownership. A non-Federal entity may have rights to inventions in accordance with 37 C.F.R. Part 401. These requirements are technical in nature and non-Federal entities are encouraged to consult with their Intellectual Property counsel to ensure the proper interpretation of and adherence to the ownership rules. Unresolved questions pertaining to a non-Federal entities' ownership rights may further be addressed to the Grants Officer.

2. Responsibilities - iEdison. The non-Federal entity must comply with all the requirements of the standard patent rights clause and 37 C.F.R. Part 401, including the standard patent rights clause in 37 C.F.R. § 401.14. Non-Federal entities are required to submit their disclosures, elections, and requests for waiver from any requirement for substantial U.S. manufacture, electronically using the Interagency Edison extramural invention reporting system (iEdison) at www.iedison.gov. Non-Federal entities may obtain a waiver of this electronic submission requirement by providing the Grants Officer with compelling reasons for allowing the submission of paper reports.

c. Patent Notification Procedures. Pursuant to E.O. 12889 (58 FR 69681), the DOC is required to notify the owner of any valid patent covering technology whenever the DOC or a non-Federal entity, without making a patent search, knows (or has demonstrable reasonable grounds to know) that technology covered by a valid United States patent has been or will be used without a license from the owner. To ensure proper notification, if the non-Federal entity uses or has used patented technology under this award without a license or permission from the owner, the non-Federal entity must notify the Grants Officer.

This notice does not constitute authorization or consent by the Government to any copyright or patent infringement occurring under the award.

d. A non-Federal entity may copyright any work produced under a Federal award, subject to the DOC's royalty-free, nonexclusive, and irrevocable right to obtain, reproduce, publish, or otherwise use the work, or authorize others to do so for Government purposes. Works jointly authored by DOC and non-Federal entity employees may be copyrighted, but only the part of such works authored by the non-Federal entity is protectable in the United States because, under 17 U.S.C. § 105, copyright protection is not available within the United States for any work of the United States Government. On occasion and as permitted under 17 U.S.C. § 105, DOC may require the non-Federal entity to transfer to DOC a copyright in a particular work for Government purposes or when DOC is undertaking primary dissemination of the work.

e. Freedom of Information Act (FOIA). In response to a FOIA request for research data relating to published research findings (as defined by 2 C.F.R. § 200.315(e)(2)) produced under a Federal award that were used by the Federal government in developing an agency action that has the force and effect of law, the DOC will request, and the non-Federal entity must provide, within a reasonable time, the research data so that they can be made available to the public through the procedures established under the FOIA.

D. AUDITS

Under the Inspector General Act of 1978, as amended, 5 U.S.C. App. 3, §§ 1 *et seq.*, an audit of the award may be conducted at any time. The Inspector General of the DOC, or any of his or her duly authorized representatives, must have the right to access any pertinent books, documents, papers, and records of the non-Federal entity, whether written, printed, recorded, produced, or reproduced by any electronic, mechanical, magnetic, or other process or medium, to make audits, inspections, excerpts, transcripts, or other examinations as authorized by law. This right also includes timely and reasonable access to the non-Federal entity's personnel for interview and discussion related to such documents. See 2 C.F.R. § 200.337 (Access to records). When the DOC Office of Inspector General (OIG) requires a program audit on a DOC award, the OIG will usually make the arrangements to audit the award, whether the audit is performed by OIG personnel, an independent accountant under contract with DOC, or any other Federal, State, or local audit entity.

.01 Organization-Wide, Program-Specific, and Project Audits

a. A recipient must, within 90 days of the end of its fiscal year, notify the Grants Officer of the amount of Federal awards, including all DOC and non-DOC awards, that the recipient expended during its fiscal year.

b. Recipients that are subject to the provisions of Subpart F of 2 C.F.R. Part 200 and that expend \$750,000 or more in a year in Federal awards during their fiscal year must have an audit conducted for that year in accordance with the requirements contained in Subpart F of 2 C.F.R. Part 200. Within the earlier of 30 calendar days after receipt of the auditor's report(s), or nine months after the end of the audit period, unless a different period is specified in a program-specific audit guide, a copy of the audit must be submitted electronically to the Federal Audit Clearinghouse (FAC) through the FAC's Internet Data Entry System (IDES) (<https://harvester.census.gov/facides/>). In accordance with 2 C.F.R. § 200.425 (Audit services), the recipient may include a line item in the budget for the allowable costs associated with the audit, which is subject to the approval of the Grants Officer.

c. Unless otherwise specified in the terms and conditions of the award, entities that are not subject to Subpart F of 2 C.F.R. Part 200 (e.g., for-profit entities, foreign public entities and foreign organizations) and that expend \$750,000 or more in DOC funds during their fiscal year (including both as a recipient and a subrecipient) must submit to the Grants Officer either: (i) a financial related audit of each DOC award or subaward in accordance with Generally Accepted Government Auditing Standards (GAGAS); or (ii) a project specific audit for each award or subaward in accordance with the requirements contained in 2 C.F.R. § 200.507. Within the earlier of 30 calendar days after receipt of the auditor's report(s), or nine months after the end of the audit period, unless a different period is specified in a program-specific audit guide, a copy of the audit must be submitted to the Grants Officer. In accordance with 2 C.F.R. § 200.425, the recipient may include a line item in the budget for the allowable costs associated with the audit, which is subject to the approval of the Grants Officer. Entities that are not subject to Subpart F of 2 C.F.R. Part 200 and that expend less than \$750,000 in DOC funds in a given fiscal year are

not required to submit an audit(s) for that year, but must make their award-related records available to DOC or other designated officials for review and audit.

d. Recipients are responsible for compliance with the above audit requirements and for informing the Grants Officer of the status of their audit, including when the relevant audit has been completed and submitted in accordance with the requirements of this section. Failure to provide audit reports within the timeframes specified above may result in appropriate enforcement action, up to and including termination of the award, and may jeopardize eligibility for receiving future DOC awards.

e. In accordance with 2 C.F.R. § 200.332(d)(3), pass-through entities are responsible for issuing a management decision for applicable audit findings pertaining only to the Federal award provided by the pass-through entity to a subrecipient.

.02 Audit Resolution Process

a. An audit of the award may result in the disallowance of costs incurred by the recipient and the establishment of a debt (account receivable) due to DOC. For this reason, the recipient should take seriously its responsibility to respond to all audit findings and recommendations with adequate explanations and supporting evidence whenever audit results are disputed.

b. A recipient whose award is audited has the following opportunities to dispute the proposed disallowance of costs and the establishment of a debt:

1. The recipient has 30 calendar days from the date of the transmittal of the draft audit report to submit written comments and documentary evidence.
2. The recipient has 30 calendar days from the date of the transmittal of the final audit report to submit written comments and documentary evidence.
3. The DOC will review the documentary evidence submitted by the recipient and will notify the recipient of the results in an *Audit Resolution Determination Letter*. The recipient has 30 calendar days from the date of receipt of the *Audit Resolution Determination Letter* to submit a written appeal, unless this deadline is extended in writing by the DOC. The appeal is the last opportunity for the recipient to submit written comments and documentary evidence to the DOC to dispute the validity of the audit resolution determination.
4. An appeal of the Audit Resolution Determination does not prevent the establishment of the audit-related debt nor does it prevent the accrual of applicable interest, penalties and administrative fees on the debt in accordance with 15 C.F.R. Part 19. If the Audit Resolution Determination is overruled or modified on appeal, appropriate corrective action will be taken retroactively.
5. The DOC will review the recipient's appeal and notify the recipient of the results in an *Appeal Determination Letter*. After the opportunity to appeal has expired or after the appeal determination has been rendered, DOC will not accept any further documentary evidence from the recipient. No other administrative appeals are available in DOC.

E. DEBTS

.01 Payment of Debts Owed to the Federal Government

a. The non-Federal entity must promptly pay any debts determined to be owed to the Federal Government. Any funds paid to a non-Federal entity in excess of the amount to which the non-Federal entity is finally determined to be entitled under the terms of the Federal award constitute a debt to the Federal government. In accordance with 2 C.F.R. § 200.346 (Collection of amounts due), if not paid within 90 calendar days after demand, DOC may reduce a debt owed to the Federal Government by:

1. Making an administrative offset against other requests for reimbursement;
2. Withholding advance payments otherwise due to the non-Federal entity; or
3. Taking any other action permitted by Federal statute.

The foregoing does not waive any claim on a debt that DOC may have against another entity, and all rights and remedies to pursue other parties are preserved.

b. DOC debt collection procedures are set out in 15 C.F.R. Part 19. In accordance with 2 C.F.R. § 200.346 (Collection of amounts due) and 31 U.S.C. § 3717, failure to pay a debt owed to the Federal Government must result in the assessment of interest, penalties and administrative costs in accordance with the provisions of 31 U.S.C. § 3717 and 31 C.F.R. § 901.9. Commerce entities will transfer any Commerce debt that is delinquent for more than 120 calendar days to the U.S. Department of the Treasury's Financial Management Service for debt collection services, a process known as cross-servicing, pursuant to 31 U.S.C. § 3711(g), 31 C.F.R. § 285.12, and 15 C.F.R. § 19.9. DOC may also take further action as specified in DOC ST&C A.06 (Unsatisfactory Performance or Non-Compliance with Award Provisions). Funds for payment of a debt must not come from other Federally-sponsored programs, and the DOC may conduct on-site visits, audits, and other reviews to verify that other Federal funds have not been used to pay a debt.

.02 Late Payment Charges

a. Interest will be assessed on the delinquent debt in accordance with section 11 of the Debt Collection Act of 1982, as amended (31 U.S.C. § 3717(a)). The minimum annual interest rate to be assessed is the U.S. Department of the Treasury's Current Value of Funds Rate (CVFR). The CVFR is available online at https://www.fiscal.treasury.gov/fsreports/rpt/cvfr/cvfr_home.htm and also published by the Department of the Treasury in the *Federal Register* (<http://www.gpo.gov/fdsys/browse/collection.action?collectionCode=FR>) and in the *Treasury Financial Manual Bulletin*. The assessed rate must remain fixed for the duration of the indebtedness.

b. Penalties will accrue at a rate of not more than six percent per year or such other higher rate as authorized by law.

c. Administrative charges, i.e., the costs of processing and handling a delinquent debt, will be determined by the Commerce entity collecting the debt, as directed by the Office of the Chief Financial Officer and Assistant Secretary for Administration.

.03 Barring Delinquent Federal Debtors from Obtaining Federal Loans or Loan Insurance Guarantees

Pursuant to 31 U.S.C. § 3720B and 31 C.F.R. § 901.6, unless waived by DOC, the DOC is not permitted to extend financial assistance in the form of a loan, loan guarantee, or loan insurance to any person delinquent on a nontax debt owed to a Federal agency. This prohibition does not apply to disaster loans.

.04 Effect of Judgment Lien on Eligibility for Federal Grants, Loans, or Programs

Pursuant to 28 U.S.C. § 3201(e), unless waived by the DOC, a debtor who has a judgment lien against the debtor's property for a debt to the United States is not eligible to receive any grant or loan that is made, insured, guaranteed, or financed directly or indirectly by the United States or to receive funds directly from the Federal Government in any program, except funds to which the debtor is entitled as beneficiary, until the judgment is paid in full or otherwise satisfied.

F. CONFLICT OF INTEREST, CODE OF CONDUCT AND OTHER REQUIREMENTS PERTAINING TO DOC FINANCIAL ASSISTANCE AWARDS, INCLUDING SUBAWARD AND PROCUREMENT ACTIONS

.01 Conflict of Interest and Code of Conduct

a. DOC Conflict of Interest Policy. In accordance with 2 C.F.R. § 200.112 (Conflict of interest), the non-Federal entity must disclose in writing any potential conflict of interest to the DOC or pass-through entity. In addition, a non-Federal entity will establish and maintain written standards of conduct that include safeguards to prohibit employees from using their positions for a purpose that constitutes or presents the appearance of personal or organizational conflict of interest, or personal gain in the administration of an award. It is the DOC's policy to maintain the highest standards of conduct and to prevent real or apparent conflicts of interest in connection with DOC financial assistance awards.

b. A conflict of interest generally exists when an interested party participates in a matter that has a direct and predictable effect on the interested party's personal or financial interests. A financial interest may include employment, stock ownership, a creditor or debtor relationship, or prospective employment with the organization selected or to be selected for a subaward. A conflict also may exist where there is an appearance that an interested party's objectivity in performing his or her responsibilities under the project is impaired. For example, an appearance of impairment of objectivity may result from an organizational conflict where, because of other activities or relationships with other persons or entities, an interested party is unable to render

impartial assistance, services or advice to the recipient, a participant in the project or to the Federal Government. Additionally, a conflict of interest may result from non-financial gain to an interested party, such as benefit to reputation or prestige in a professional field. For purposes of the DOC Conflict of Interest Policy, an interested party includes, but is not necessarily limited to, any officer, employee or member of the board of directors or other governing board of a non-Federal entity, including any other parties that advise, approve, recommend, or otherwise participate in the business decisions of the recipient, such as agents, advisors, consultants, attorneys, accountants or shareholders. This also includes immediate family and other persons directly connected to the interested party by law or through a business arrangement.

c. Procurement-related conflict of interest. In accordance with 2 C.F.R. § 200.318 (General procurement standards), non-Federal entities must maintain written standards of conduct covering conflicts of interest and governing the performance of their employees engaged in the selection, award and administration of contracts. See paragraph F.04 of these Standard Terms (Requirements for Procurements).

.02 Nonprocurement Debarment and Suspension

Non-Federal entities must comply with the provisions of 2 C.F.R. Part 1326 (Nonprocurement Debarment and Suspension), which generally prohibit entities that have been debarred, suspended, or voluntarily excluded from participating in Federal nonprocurement transactions either through primary or lower tier covered transactions, and which set forth the responsibilities of recipients of Federal financial assistance regarding transactions with other persons, including subrecipients and contractors.

.03 Requirements for Subawards

a. The recipient or pass-through entity must require all subrecipients, including lower tier subrecipients, to comply with the terms and conditions of a DOC financial assistance award, including applicable provisions of the OMB Uniform Guidance (2 C.F.R. Part 200), and all associated Terms and Conditions set forth herein. See 2 C.F.R. § 200.101(b)(2) (Applicability to different types of Federal awards), which describes the applicability of 2 C.F.R. Part 200 to various types of Federal awards and §§ 200.331-333 (Subrecipient monitoring and management).

b. The recipient or pass through entity may have more restrictive policies for the RTC **waived** prior approvals (no-cost extensions, re-budgeting, etc.) for their subaward recipients. Such restrictive policies must be addressed in their subaward agreements and in accordance with §200.331.

.04 Requirements for Procurements

a. States. Pursuant to 2 C.F.R. § 200.317 (Procurements by states), when procuring property and services under this Federal award, a State must follow the same policies and procedures it uses for procurements from its non-Federal funds. The State must comply with 2 C.F.R. §§ 200.321 (Contracting with small and minority businesses, women's business enterprises, and labor surplus area firms), 200.322 (Domestic preferences for procurements), and

200.323 (Procurement of recovered materials), and ensure that every purchase order or other contract includes any clauses required by 2 C.F.R. § 200.327 (Contract provisions).

b. Other Non-Federal Entities. All other non-Federal entities, including subrecipients of a State, must follow the procurement standards in 2 C.F.R. §§ 200.318 (General procurement standards) through 200.327 (Contract provisions) which include the requirement that non-Federal entities maintain written standards of conduct covering conflicts of interest and governing the performance of their employees engaged in the selection, award, and administration of contracts. No employee, officer, or agent may participate in the selection, award, or administration of a contract supported by a Federal award if he or she has a real or apparent conflict of interest.

.05 Whistleblower Protections

This award is subject to the whistleblower protections afforded by 41 U.S.C. § 4712 (Enhancement of contractor protection from reprisal for disclosure of certain information), which generally provide that an employee or contractor (including subcontractors and personal services contractors) of a non-Federal entity may not be discharged, demoted, or otherwise discriminated against as a reprisal for disclosing to a person or body information that the employee reasonably believes is evidence of gross mismanagement of a Federal award, subaward, or a contract under a Federal award or subaward, a gross waste of Federal funds, an abuse of authority relating to a Federal award or subaward or contract under a Federal award or subaward, a substantial and specific danger to public health or safety, or a violation of law, rule, or regulation related to a Federal award, subaward, or contract under a Federal award or subaward. These persons or bodies include:

- a. A Member of Congress or a representative of a committee of Congress.
- b. An Inspector General.
- c. The Government Accountability Office.
- d. A Federal employee responsible for contract or grant oversight or management at the relevant agency.
- e. An authorized official of the Department of Justice or other law enforcement agency.
- f. A court or grand jury.
- g. A management official or other employee of the contractor, subcontractor, or grantee who has the responsibility to investigate, discover, or address misconduct.

Non-Federal entities and contractors under Federal awards and subawards must inform their employees in writing of the rights and remedies provided under 41 U.S.C. § 4712, in the predominant native language of the workforce.

.06 Small Businesses, Minority Business Enterprises and Women's Business Enterprises

In accordance with 2 C.F.R. § 200.321 (Contracting with small and minority businesses, women's business enterprises, and labor surplus area firms), the recipient must take all necessary affirmative steps to assure that minority businesses, women's business enterprises, and labor surplus area firms are used when possible. DOC encourages non-Federal entities to use small

businesses, minority business enterprises and women's business enterprises in contracts under financial assistance awards. The Minority Business Development Agency within the DOC will assist non-Federal entities in matching qualified minority business enterprises with contract opportunities. For further information visit MBDA's website at <http://www.mbda.gov>. If you do not have access to the Internet, you may contact MBDA via telephone or mail:

U.S. Department of Commerce
Minority Business Development Agency
Herbert C. Hoover Building
14th Street and Constitution Avenue, N.W.
Washington, D.C. 20230
(202) 482-0101

G. NATIONAL POLICY REQUIREMENTS

.01 United States Laws and Regulations

This award is subject to the laws and regulations of the United States. The recipient must comply with all applicable requirements of all other Federal laws, executive orders, regulations and policies governing this program.

.02 Non-Discrimination Requirements

No person in the United States may, on the ground of race, color, national origin, handicap, age, religion, or sex, be excluded from participation in, be denied the benefits of, or be subject to discrimination under, any program or activity receiving Federal financial assistance. The recipient agrees to comply with the non-discrimination requirements below:

a. Statutory Provisions

1. Title VI of the Civil Rights Act of 1964 (42 U.S.C. §§ 2000d *et seq.*) and DOC implementing regulations published at 15 C.F.R. Part 8 prohibiting discrimination on the grounds of race, color, or national origin under programs or activities receiving Federal financial assistance;
2. Title IX of the Education Amendments of 1972 (20 U.S.C. §§ 1681 *et seq.*) prohibiting discrimination on the basis of sex under Federally assisted education programs or activities;
3. The Americans with Disabilities Act of 1990 (42 U.S.C. §§ 12101 *et seq.*) prohibiting discrimination on the basis of disability under programs, activities, and services provided or made available by State and local governments or instrumentalities or agencies thereto, as well as public or private entities that provide public transportation;
4. Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. § 794), and DOC implementing regulations published at 15 C.F.R. Part 8b prohibiting discrimination on the

basis of handicap under any program or activity receiving or benefiting from Federal assistance.

For purposes of complying with the accessibility standards set forth in 15 C.F.R. § 8b.18(c), non-federal entities must adhere to the regulations, published by the U.S. Department of Justice, implementing Title II of the Americans with Disabilities Act (ADA) (28 C.F.R. part 35; 75 FR 56164, as amended by 76 FR 13285) and Title III of the ADA (28 C.F.R. part 36; 75 FR 56164, as amended by 76 FR 13286). The revised regulations adopted new enforceable accessibility standards called the “2010 ADA Standards for Accessible Design” (2010 Standards), which replace and supersede the former Uniform Federal Accessibility Standards for new construction and alteration projects;

5. The Age Discrimination Act of 1975, as amended (42 U.S.C. §§ 6101 *et seq.*), and DOC implementing regulations published at 15 C.F.R. Part 20 prohibiting discrimination on the basis of age in programs or activities receiving Federal financial assistance; and
6. Any other applicable non-discrimination law(s).

b. Other Provisions

1. Parts II and III of E.O. 11246 (Equal Employment Opportunity, 30 FR 12319),³ which requires Federally assisted construction contracts to include the nondiscrimination provisions of §§ 202 and 203 of E.O. 11246 and Department of Labor regulations implementing E.O. 11246 (41 C.F.R. § 60-1.4(b)).
2. E.O. 13166 (65 FR 50121, Improving Access to Services for Persons with Limited English Proficiency), requiring Federal agencies to examine the services provided, identify any need for services to those with limited English proficiency (LEP), and develop and implement a system to provide those services so LEP persons can have meaningful access to them. The DOC issued policy guidance on March 24, 2003 (68 FR 14180) to articulate the Title VI prohibition against national origin discrimination affecting LEP persons and to help ensure that non-Federal entities provide meaningful access to their LEP applicants and beneficiaries.
3. In accordance with E.O. 13798 and Office of Management and Budget, M-20-09 – Guidance Regarding Federal Grants, states or other public grantees may not condition sub-awards of Federal grant money in a manner that would disadvantage grant applicants based on their religious character.

³ As amended by E.O. 11375(32 FR 14303), E.O. 11478 (34 FR 12985), E.O. 12086 (43 FR 46501), E.O. 12107 (44 FR 1055), E.O. 13279 (F67 FR 77141), E.O. 13665 (79 FR 20749), and E.O. 13672 (79 FR 42971).

c. Title VII Exemption for Religious Organizations

Generally, Title VII of the Civil Rights Act of 1964, 42 U.S.C. §§ 2000e *et seq.*, provides that it is an unlawful employment practice for an employer to discharge any individual or otherwise to discriminate against an individual with respect to compensation, terms, conditions, or privileges of employment because of such individual's race, color, religion, sex, or national origin. However, Title VII, 42 U.S.C. § 2000e-1(a), expressly exempts from the prohibition against discrimination based on religion, "a religious corporation, association, educational institution, or society with respect to the employment of individuals of a particular religion to perform work connected with the carrying on by such corporation, association, educational institution, or society of its activities."

.03 LOBBYING RESTRICTIONS

a. Statutory Provisions

Non-Federal entities must comply with 2 C.F.R. § 200.450 (Lobbying), which incorporates the provisions of 31 U.S.C. § 1352; and OMB guidance and notices on lobbying restrictions. In addition, non-Federal entities must comply with the DOC regulations published at 15 C.F.R. Part 28, which implement the New Restrictions on Lobbying. These provisions prohibit the use of Federal funds for lobbying the executive or legislative branches of the Federal Government in connection with the award and require the disclosure of the use of non-Federal funds for lobbying. Lobbying includes attempting to improperly influence, meaning any influence that induces or tends to induce a Federal employee or officer to give consideration or to act regarding a Federal award or regulatory matter on any basis other than the merits of the matter, either directly or indirectly. Costs incurred to improperly influence are unallowable. See 2 C.F.R. § 200.450(b) and (c).

b. Disclosure of Lobbying Activities

Any recipient that receives more than \$100,000 in Federal funding and conducts lobbying with non-federal funds relating to a covered Federal action must submit a completed Form SF-LLL (Disclosure of Lobbying Activities). The Form SF-LLL must be submitted within 30 calendar days following the end of the calendar quarter in which there occurs any event that requires disclosure or that materially affects the accuracy of the information contained in any disclosure form previously filed. The recipient must submit any required SF-LLL forms, including those received from subrecipients, contractors, and subcontractors, to the Grants Officer.

.04 Environmental Requirements

Environmental impacts must be considered by Federal decision makers in their decisions whether or not to approve: (1) a proposal for Federal assistance; (2) the proposal with mitigation; or (3) a different proposal having less adverse environmental impacts. Federal environmental laws require that the funding agency initiate an early planning process that considers potential impacts that projects funded with Federal assistance may have on the environment. Each non-Federal entity must comply with all environmental standards, to include those prescribed under

the following statutes and E.O.s and must identify to the awarding agency any impact the award may have on the environment. In some cases, award funds can be withheld by the Grants Officer under a specific award condition requiring the non-Federal entity to submit additional environmental compliance information sufficient to enable the DOC to make an assessment on any impacts that a project may have on the environment.

a. The National Environmental Policy Act (42 U.S.C. §§ 4321 *et seq.*)

The National Environmental Policy Act (NEPA) and the Council on Environmental Quality (CEQ) implementing regulations (40 C.F.R. Parts 1500 through 1508) require that an environmental analysis be completed for all major Federal actions to determine whether they have significant impacts on the environment. NEPA applies to the actions of Federal agencies and may include a Federal agency's decision to fund non-Federal projects under grants and cooperative agreements when the award activities remain subject to Federal authority and control. Non-Federal entities are required to identify to the awarding agency any direct, indirect or cumulative impact an award will have on the quality of the human environment and assist the agency in complying with NEPA. Non-Federal entities may also be requested to assist DOC in drafting an environmental assessment or environmental impact statement if DOC determines such documentation is required, but DOC remains responsible for the sufficiency and approval of the final documentation. Until the appropriate NEPA documentation is complete and in the event that any additional information is required during the period of performance to assess project environmental impacts, funds can be withheld by the Grants Officer under a specific award condition requiring the non-Federal entity to submit the appropriate environmental information and NEPA documentation sufficient to enable DOC to make an assessment on any impacts that a project may have on the environment.

b. The National Historic Preservation Act (16 U.S.C. §§ 470 *et seq.*)

Section 106 of the National Historic Preservation Act (NHPA) (16 U.S.C. § 470f) and the Advisory Council on Historic Preservation (ACHP) implementing regulations (36 C.F.R. Part 800) require that Federal agencies take into account the effects of their undertakings on historic properties and, when appropriate, provide the ACHP with a reasonable opportunity to comment. Historic properties include but are not necessarily limited to districts, buildings, structures, sites and objects. In this connection, archeological resources and sites that may be of traditional religious and cultural importance to Federally-recognized Indian Tribes, Alaskan Native Villages and Native Hawaiian Organizations may be considered historic properties. Non-Federal entities are required to identify to the awarding agency any effects the award may have on properties included on or eligible for inclusion on the National Register of Historic Places. Non-Federal entities may also be requested to assist DOC in consulting with State or Tribal Historic Preservation Officers, ACHPs or other applicable interested parties necessary to identify, assess, and resolve adverse effects to historic properties. Until such time as the appropriate NHPA consultations and documentation are complete and in the event that any additional information is required during the period of performance in order to assess project impacts on historic properties, funds can be withheld by the Grants Officer under a specific award condition requiring the non-Federal entity to

submit any information sufficient to enable DOC to make the requisite assessment under the NHPA.

Additionally, non-Federal entities are required to assist the DOC in assuring compliance with the Archeological and Historic Preservation Act of 1974 (54 U.S.C. § 312502 *et seq.*, formerly 16 U.S.C. § 469a-1 *et seq.*); Executive Order 11593 (Protection and Enhancement of the Cultural Environment, May 13, 1971); Executive Order 13006 (Locating Federal Facilities on Historic Properties in Our Nation's Central Cities, May 21, 1996); and Executive Order 13007 (Indian Sacred Sites, May 24, 1996).

c. Executive Order 11988 (Floodplain Management) and Executive Order 11990 (Protection of Wetlands)

Non-Federal entities must identify proposed actions in Federally defined floodplains and wetlands to enable DOC to decide whether there is an alternative to minimize any potential harm.

d. Clean Air Act (42 U.S.C. §§ 7401 *et seq.*), Federal Water Pollution Control Act (33 U.S.C. §§ 1251 *et seq.*) (Clean Water Act), and Executive Order 11738 ("Providing for administration of the Clean Air Act and the Federal Water Pollution Control Act with respect to Federal contracts, grants or loans")

Non-Federal entities must comply with the provisions of the Clean Air Act (42 U.S.C. §§ 7401 *et seq.*), Clean Water Act (33 U.S.C. §§ 1251 *et seq.*), and E.O. 11738 (38 FR 25161), and must not use a facility on the Excluded Parties List (EPL) (located on the System for Award Management (SAM) website, SAM.gov) in performing any award that is nonexempt under 2 C.F.R. § 1532, and must notify the Program Officer in writing if it intends to use a facility that is on the EPL or knows that the facility has been recommended to be placed on the EPL.

e. The Flood Disaster Protection Act (42 U.S.C. §§ 4002 *et seq.*)

Flood insurance, when available, is required for Federally assisted construction or acquisition in flood-prone areas. Per 2 C.F.R. § 200.447(a), the cost of required flood insurance is an allowable expense, if it is reflected in the approved project budget.

f. The Endangered Species Act (16 U.S.C. §§ 1531 *et seq.*)

Non-Federal entities must identify any impact or activities that may involve a threatened or endangered species. Federal agencies have the responsibility to ensure that no adverse effects to a protected species or habitat occur from actions under Federal assistance awards and conduct the reviews required under the Endangered Species Act, as applicable.

g. The Coastal Zone Management Act (16 U.S.C. §§ 1451 *et seq.*)

Funded projects must be consistent with a coastal State's approved management program for the coastal zone.

h. The Coastal Barriers Resources Act (16 U.S.C. §§ 3501 *et seq.*)

Only in certain circumstances can Federal funding be provided for actions within a Coastal Barrier System.

i. The Wild and Scenic Rivers Act (16 U.S.C. §§ 1271 *et seq.*)

This Act applies to awards that may affect existing or proposed components of the National Wild and Scenic Rivers system.

j. The Safe Drinking Water Act of 1974, as amended, (42 U.S.C. §§ 300f *et seq.*)

This Act precludes Federal assistance for any project that the EPA determines may contaminate a sole source aquifer which threatens public health.

k. The Resource Conservation and Recovery Act (42 U.S.C. §§ 6901 *et seq.*)

This Act regulates the generation, transportation, treatment, and disposal of hazardous wastes, and provides that non-Federal entities give preference in their procurement programs to the purchase of recycled products pursuant to EPA guidelines.

l. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, commonly known as Superfund) (42 U.S.C. §§ 9601 *et seq.*) and the Community Environmental Response Facilitation Act (42 U.S.C. § 9601 note *et seq.*)

These requirements address responsibilities related to hazardous substance releases, threatened releases and environmental cleanup. There are also reporting and community involvement requirements designed to ensure disclosure of the release or disposal of regulated substances and cleanup of hazards to state and local emergency responders.

m. Executive Order 12898 (“Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations”)

Federal agencies are required to identify and address the disproportionately high and adverse human health or environmental effects of Federal programs, policies, and activities on low income and minority populations.

n. The Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. § 1801 *et seq.*)

Non-Federal entities must identify to DOC any effects the award may have on essential fish habitat (EFH). Federal agencies which fund, permit, or carry out activities that may adversely impact EFH are required to consult with the National Marine Fisheries Service (NMFS) regarding the potential effects of their actions and respond in writing to NMFS recommendations. These recommendations may include measures to avoid, minimize, mitigate, or otherwise offset adverse effects on EFH. In addition, NMFS is required to comment on any state agency activities that would impact EFH. Provided the specifications outlined in the regulations are met, EFH consultations will be incorporated into interagency

procedures previously established under NEPA, the ESA, Clean Water Act, Fish and Wildlife Coordination Act, or other applicable statutes.

o. Clean Water Act (CWA) Section 404 (33 U.S.C. § 1344)

CWA Section 404 regulates the discharge of dredged or fill material into waters of the United States, including wetlands. Activities in waters of the United States regulated under this program include fill for development, water resource projects (such as levees and some coastal restoration activities), and infrastructure development (such as highways and airports). CWA Section 404 requires a permit from the U.S. Army Corps of Engineers before dredged or fill material may be discharged into waters of the United States, unless the activity is exempt from Section 404 regulation (e.g., certain farming and forestry activities).

p. Rivers and Harbors Act (33 U.S.C. § 407)

A permit may be required from the U.S. Army Corps of Engineers if the proposed activity involves any work in, over or under navigable waters of the United States. Recipients must identify any work (including structures) that will occur in, over or under navigable waters of the United States and obtain the appropriate permit, if applicable.

q. The Migratory Bird Treaty Act (16 U.S.C. §§ 703-712), Bald and Golden Eagle Protection Act (16 U.S.C. § 668 *et seq.*), and Executive Order 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds, January 10, 2001)

Many prohibitions and limitations apply to projects that adversely impact migratory birds and bald and golden eagles. Executive Order 13186 directs Federal agencies to enter a Memorandum of Understanding with the U.S. Fish and Wildlife Service to promote conservation of migratory bird populations when a Federal action will have a measurable negative impact on migratory birds.

r. Executive Order 13112 (Invasive Species, February 3, 1999)

Federal agencies must identify actions that may affect the status of invasive species and use relevant programs and authorities to: (i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (iii) monitor invasive species populations accurately and reliably; (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and (vi) promote public education on invasive species and the means to address them. In addition, an agency may not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere.

s. Fish and Wildlife Coordination Act (16 U.S.C. § 661 *et seq.*)

During the planning of water resource development projects, agencies are required to give fish and wildlife resources equal consideration with other values. Additionally, the U.S.

Fish and Wildlife Service and fish and wildlife agencies of states must be consulted whenever waters of any stream or other body of water are “proposed or authorized, permitted or licensed to be impounded, diverted... or otherwise controlled or modified” by any agency under a Federal permit or license.

.05 OTHER NATIONAL POLICY REQUIREMENTS

a. Buy-American Preferences

Strengthening Buy-American Preferences for Infrastructure Projects. Recipients of covered programs (as defined in Executive Order 13858, 31 January 2019, and 2 C.F.R. §200.322 (Domestic preferences for procurements)) are hereby notified that they are encouraged to use, to the greatest extent practicable, iron and aluminum as well as steel, cement, and other manufactured products produced in the United States in every contract, subcontract, purchase order, or subaward that is chargeable under this Award.

b. Criminal and Prohibited Activities

1. The Program Fraud Civil Remedies Act (31 U.S.C. § 3801 *et seq.*), provides for the imposition of civil penalties against persons who make false, fictitious, or fraudulent claims to the Federal Government for money (including money representing grants, loans, or other benefits).
2. The False Claims Amendments Act of 1986 and the False Statements Accountability Act of 1996 (18 U.S.C. §§ 287 and 1001, respectively), provide that whoever makes or presents any false, fictitious, or fraudulent statement, representation, or claim against the United States must be subject to imprisonment of not more than five years and must be subject to a fine in the amount provided by 18 U.S.C. § 287.
3. The Civil False Claims Act (31 U.S.C. §§ 3729 - 3733), provides that suits can be brought by the government, or a person on behalf of the government, for false claims made under Federal assistance programs.
4. The Copeland Anti-Kickback Act (18 U.S.C. § 874), prohibits a person or organization engaged in a Federally supported project from enticing an employee working on the project from giving up a part of his compensation under an employment contract. The Copeland Anti-Kickback Act also applies to contractors and subcontractors pursuant to 40 U.S.C. § 3145.
5. The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 U.S.C. § 4601 *et seq.*) and implementing regulations issued at 15 C.F.R. Part 11, which provides for fair and equitable treatment of displaced persons or persons whose property is acquired as a result of Federal or Federally-assisted programs. These requirements apply to all interests in real property acquired for project purposes regardless of Federal participation in purchases.

6. The Hatch Act (5 U.S.C. §§ 1501-1508 and 7321-7326), which limits the political activities of employees or officers of state or local governments whose principal employment activities are funded in whole or in part with Federal funds.

7. To ensure compliance with Federal law pertaining to financial assistance awards, an authorized representative of a non-Federal entity may be required to periodically provide certain certifications to the DOC regarding Federal felony and Federal criminal tax convictions, unpaid federal tax assessments, delinquent Federal tax returns and such other certifications that may be required by Federal law.

c. Drug-Free Workplace

The non-Federal entity must comply with the provisions of the Drug-Free Workplace Act of 1988 (41 U.S.C. § 8102) and DOC implementing regulations published at 2 C.F.R. Part 1329 (Requirements for Drug-Free Workplace (Financial Assistance)), which require that the non-Federal entity take certain actions to provide a drug-free workplace.

d. Foreign Travel

1. Each non-Federal entity must comply with the provisions of the Fly America Act (49 U.S.C. § 40118). The implementing regulations of the Fly America Act are found at 41 C.F.R. §§ 301-10.131 through 301-10.143.

2. The Fly America Act requires that Federal travelers and others performing U.S. Government-financed air travel must use U.S. flag air carriers, to the extent that service by such carriers is available. Foreign air carriers may be used only in specific instances, such as when a U.S. flag air carrier is unavailable or use of U.S. flag air carrier service will not accomplish the agency's mission.

3. One exception to the requirement to fly U.S. flag carriers is transportation provided under a bilateral or multilateral air transport agreement, to which the United States Government and the government of a foreign country are parties, and which the Department of Transportation has determined meets the requirements of the Fly America Act pursuant to 49 U.S.C. § 40118(b). The United States Government has entered into bilateral/multilateral "Open Skies Agreements" (U.S. Government Procured Transportation) that allow federal funded transportation services for travel and cargo movements to use foreign air carriers under certain circumstances. There are multiple "Open Skies Agreements" currently in effect. For more information about the current bilateral and multilateral agreements, visit the GSA [website](#). Information on the Open Skies agreements (U.S. Government Procured Transportation) and other specific country agreements may be accessed via the Department of State's [website](#).

4. If a foreign air carrier is anticipated to be used for any portion of travel under a DOC financial assistance award, the non-Federal entity must receive prior approval from the Grants Officer. When requesting such approval, the non-Federal entity must provide a justification in accordance with guidance provided by 41 C.F.R. § 301-10.142, which requires the non-Federal entity to provide the Grants Officer with the following: name; dates

of travel; origin and destination of travel; detailed itinerary of travel; name of the air carrier and flight number for each leg of the trip; and a statement explaining why the non-Federal entity meets one of the exceptions to the regulations. If the use of a foreign air carrier is pursuant to a bilateral agreement, the non-Federal entity must provide the Grants Officer with a copy of the agreement or a citation to the official agreement available on the GSA website. The Grants Officer must make the final determination and notify the non-Federal entity in writing (which may be done through the recipient in the case of subrecipient travel). Failure to adhere to the provisions of the Fly America Act will result in the non-Federal entity not being reimbursed for any transportation costs for which any non-Federal entity improperly used a foreign air carrier.

Note: When using code-sharing flights (two or more airlines having flight numbers assigned to the same flight) involving U.S. flag carriers and non-U.S. flag carriers, the airline symbol and flight number of the U.S. flag carrier must be used on the ticket to qualify as a U.S. flag carrier (e.g. "*Delta Airlines Flight XXXX, operated by KLM*"). Conversely, if the ticket shows "[*Foreign Air Carrier*] XXX, operated by Delta," that travel is using a foreign air carrier and is subject to the Fly America Act and must receive prior approval from the Grants Officer as outlined in paragraph G.05.d.4.

e. Increasing Seat Belt Use in the United States

Pursuant to E.O. 13043 (62 FR 19217), non-Federal entities should encourage employees and contractors to enforce on-the-job seat belt policies and programs when operating company-owned, rented, or personally owned vehicles.

f. Federal Employee Expenses and Subawards or Contracts Issued to Federal Employees or Agencies

1. Use of award funds (Federal or non-Federal) or the non-Federal entity's provision of in-kind goods or services for the purposes of transportation, travel, or any other expenses for any Federal employee may raise appropriation augmentation issues. In addition, DOC policy may prohibit the acceptance of gifts, including travel payments for federal employees, from non-Federal entities regardless of the source. Therefore, before award funds may be used by Federal employees, non-Federal entities must submit requests for approval of such action to the Federal Program Officer who must review and make a recommendation to the Grants Officer. The Grants Officer will notify the non-Federal entity in writing (generally through the recipient) of the final determination.
2. A non-Federal entity or its contractor may not issue a subaward, contract or subcontract of any part of a DOC award to any agency or employee of DOC or to other Federal employee, department, agency, or instrumentality, without the advance prior written approval of the DOC Grants Officer.

g. Minority Serving Institutions Initiative

Pursuant to E.O.s 13555 (White House Initiative on Educational Excellence for Hispanics) (75 FR 65417), 13592 (Improving American Indian and Alaska Native

Educational Opportunities and Strengthening Tribal Colleges and Universities) (76 FR 76603), and 13779 (White House Initiative to Promote Excellence and Innovation at Historically Black Colleges and Universities) (82 FR 12499), DOC is strongly committed to broadening the participation of minority serving institutions (MSIs) in its financial assistance programs. DOC's goals include achieving full participation of MSIs to advance the development of human potential, strengthen the Nation's capacity to provide high-quality education, and increase opportunities for MSIs to participate in and benefit from Federal financial assistance programs. DOC encourages all applicants and non-Federal entities to include meaningful participation of MSIs. Institutions eligible to be considered MSIs are listed on the Department of Education website.

h. Research Misconduct

The DOC adopts, and applies to financial assistance awards for research, the Federal Policy on Research Misconduct (Federal Policy) issued by the Executive Office of the President's Office of Science and Technology Policy on December 6, 2000 (65 FR 76260). As provided for in the Federal Policy, research misconduct refers to the fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results. Research misconduct does not include honest errors or differences of opinion. Non-Federal entities that conduct extramural research funded by DOC must foster an atmosphere conducive to the responsible conduct of sponsored research by safeguarding against and resolving allegations of research misconduct. Non-Federal entities also have the primary responsibility to prevent, detect, and investigate allegations of research misconduct and, for this purpose, may rely on their internal policies and procedures, as appropriate, to do so. Non-Federal entities must notify the Grants Officer of any allegation that meets the definition of research misconduct and detail the entity's inquiry to determine whether there is sufficient evidence to proceed with an investigation, as well as the results of any investigation. The DOC may take appropriate administrative or enforcement action at any time under the award, up to and including award termination and possible suspension or debarment, and referral to the Commerce OIG, the U.S. Department of Justice, or other appropriate investigative body.

i. Research Involving Human Subjects

1. All proposed research involving human subjects must be conducted in accordance with 15 C.F.R. Part 27 (Protection of Human Subjects). No research involving human subjects is permitted under this award unless expressly authorized by specific award condition, or otherwise in writing by the Grants Officer.
2. Federal policy defines a human subject as a living individual about whom an investigator (whether professional or student) conducting research (1) Obtains information or biospecimens through intervention or interaction with the individual, and uses, studies, or analyzes the information or biospecimens; or (2) Obtains, uses, studies, analyzes, or generates identifiable private information or identifiable biospecimens. Research means a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge.

3. DOC regulations at 15 C.F.R. Part 27 require that non-Federal entities maintain appropriate policies and procedures for the protection of human subjects. In the event it becomes evident that human subjects may be involved in this project, the non-Federal entity (generally through the recipient) must submit appropriate documentation to the Federal Program Officer for approval by the appropriate DOC officials. As applicable, this documentation must include:

- i. Documentation establishing approval of an activity in the project by an Institutional Review Board (IRB) under a Federal wide Assurance issued by Department of Health and Human Services or other Federal agency guidelines (*see also* 15 C.F.R. § 27.103);
- ii. Documentation to support an exemption for an activity in the project under 15 C.F.R. § 27.104(d);
- iii. Documentation of IRB approval of any modification to a prior approved protocol or to an informed consent form;
- iv. Documentation of an IRB approval of continuing review approved prior to the expiration date of the previous IRB determination; and
- v. Documentation of any reportable events, such as serious adverse events, unanticipated problems resulting in risk to subjects or others, and instances of noncompliance.

4. No work involving human subjects may be undertaken, conducted, or costs incurred and/or charged for human subjects research, until the appropriate documentation is approved in writing by the Grants Officer. In accordance with 15 C.F.R. § 27.118, if research involving human subjects is proposed after an award is made, the non-Federal entity must contact the Federal Program Officer and provide required documentation. Notwithstanding this prohibition, work may be initiated or costs incurred and/or charged to the project for protocol or instrument development related to human subjects research.

j. Care and Use of Live Vertebrate Animals

Non-Federal entities must comply with the Laboratory Animal Welfare Act of 1966, as amended, (Pub. L. No. 89-544, 7 U.S.C. §§ 2131 *et seq.*) (animal acquisition, transport, care, handling, and use in projects), and implementing regulations (9 C.F.R. Parts 1, 2, and 3); the Endangered Species Act (16 U.S.C. §§ 1531 *et seq.*); Marine Mammal Protection Act (16 U.S.C. §§ 1361 *et seq.*) (taking possession, transport, purchase, sale, export or import of wildlife and plants); the Nonindigenous Aquatic Nuisance Prevention and Control Act (16 U.S.C. §§ 4701 *et seq.*) (ensure preventive measures are taken or that probable harm of using species is minimal if there is an escape or release); and all other applicable statutes pertaining to the care, handling, and treatment of warm-blooded animals held for research, teaching, or other activities supported by Federal financial assistance. No research involving vertebrate animals is permitted under any DOC financial assistance award unless authorized by the Grants Officer.

k. Management and Access to Data and Publications

1. In General. The recipient acknowledges and understands that information and data contained in applications for financial assistance, as well as information and data contained in financial, performance and other reports submitted by recipients, may be used by the DOC in conducting reviews and evaluations of its financial assistance programs. For this purpose, recipient information and data may be accessed, reviewed and evaluated by DOC employees, other Federal employees, Federal agents and contractors, and/or by non-Federal personnel, all of who enter into appropriate or are otherwise subject to confidentiality and nondisclosure agreements covering the use of such information. Recipients are expected to support program reviews and evaluations by submitting required financial and performance information and data in an accurate and timely manner, and by cooperating with DOC and external program evaluators. In accordance with 2 C.F.R. § 200.303(e), recipients are reminded that they must take reasonable measures to safeguard protected personally identifiable information and other confidential or sensitive personal or business information created or obtained relating to a DOC financial assistance award.
2. Scientific Data. Non-Federal entities must comply with the data management and access to data requirements established by the DOC funding agency as set forth in the applicable Notice of Funding Opportunity and/or in Specific Award Conditions.
3. Publications, Videos, and Acknowledgment of Sponsorship.
 - i. Publication of results or findings in appropriate professional journals and production of video or other media is encouraged as an important method of recording, reporting and otherwise disseminating information and expanding public access to federally-funded projects (*e.g.*, scientific research). Non-Federal entities must comply with the data management and access to data requirements established by the DOC funding agency as set forth in the applicable Notice of Funding Opportunity and/or in Specific Award Conditions.
 - ii. Non-Federal entities may be required to submit a copy of any publication materials, including but not limited to print, recorded, or Internet materials, to the funding agency.
 - iii. When releasing information related to a funded project, non-Federal entities must include a statement that the project or effort undertaken was or is sponsored by DOC and must also include the applicable financial assistance award number.
 - iv. Non-Federal entities are responsible for assuring that every publication of material based on, developed under, or otherwise produced pursuant to a DOC financial assistance award contains the following disclaimer or other disclaimer approved by the Grants Officer:

This [report/video/etc.] was prepared by [recipient name] using Federal funds under award [number] from [name of operating unit], U.S. Department of Commerce. The statements, findings, conclusions, and recommendations are those of the author(s) and do

not necessarily reflect the views of the [name of operating unit] or the U.S. Department of Commerce.

I. Homeland Security Presidential Directive

If the performance of this DOC financial assistance award requires non-Federal entity personnel to have routine access to Federally-controlled facilities and/or Federally-controlled information systems (for purpose of this term “routine access” is defined as more than 180 calendar days), such personnel must undergo the personal identity verification credential process. In the case of foreign nationals, the DOC will conduct a check with U.S. Citizenship and Immigration Services’ (USCIS) Verification Division, a component of the Department of Homeland Security (DHS), to ensure the individual is in a lawful immigration status and that he or she is eligible for employment within the United States. Any items or services delivered under a financial assistance award must comply with DOC personal identity verification procedures that implement Homeland Security Presidential Directive 12 (Policy for a Common Identification Standard for Federal Employees and Contractors), Federal Information Processing Standard (FIPS) PUB 201, and OMB Memorandum M-05-24. The recipient must ensure that its subrecipients and contractors (at all tiers) performing work under this award comply with the requirements contained in this term. The Grants Officer may delay final payment under an award if the subrecipient or contractor fails to comply with the requirements listed in the term below. The recipient must insert the following term in all subawards and contracts when the subaward recipient or contractor is required to have routine physical access to a Federally-controlled facility or routine access to a Federally-controlled information system:

The subrecipient or contractor must comply with DOC personal identity verification procedures identified in the subaward or contract that implement Homeland Security Presidential Directive 12 (HSPD-12), Office of Management and Budget (OMB) Guidance M-05-24, as amended, and Federal Information Processing Standards Publication (FIPS PUB) Number 201, as amended, for all employees under this subaward or contract who require routine physical access to a Federally-controlled facility or routine access to a Federally-controlled information system.

The subrecipient or contractor must account for all forms of Government-provided identification issued to the subrecipient or contractor employees in connection with performance under this subaward or contract. The subrecipient or contractor must return such identification to the issuing agency at the earliest of any of the following, unless otherwise determined by DOC: (1) When no longer needed for subaward or contract performance; (2) Upon completion of the subrecipient or contractor employee’s employment; (3) Upon subaward or contract completion or termination.

m. Compliance with Department of Commerce Bureau of Industry and Security Export Administration Regulations

1. This clause applies to the extent that this financial assistance award encompasses activities that involve export-controlled items.

2. In performing this financial assistance award, a non-Federal entity may participate in activities involving items subject to export control (export-controlled items) under the Export Administration Regulations (EAR). The non-Federal entity is responsible for compliance with all applicable laws and regulations regarding export-controlled items, including the EAR's deemed exports and re-exports provisions. The non-Federal entity must establish and maintain effective export compliance procedures at DOC and non-DOC facilities, including facilities located abroad, throughout performance of the financial assistance award. At a minimum, these export compliance procedures must include adequate restrictions on export-controlled items, to guard against any unauthorized exports, including in the form of releases or transfers to foreign nationals. Such releases or transfers may occur through visual inspection, including technology transmitted electronically, and oral or written communications.

3. Definitions

- i. Export-controlled items. Items (commodities, software, or technology), that are subject to the EAR (15 C.F.R. §§ 730-774), implemented by the DOC's Bureau of Industry and Security. These are generally known as "dual-use" items, items with a military and commercial application. The export (shipment, transmission, or release/transfer) of export-controlled items may require a license from DOC.
 - ii. Deemed Export/Re-export. The EAR defines a deemed export as a release or transfer of export-controlled items (specifically, technology or source code) to a foreign person (foreign national) in the U.S. Such release is "deemed" to be an export to the foreign person's most recent country of citizenship or permanent residency (*see* 15 C.F.R. § 734.13(a)(2) & (b)). A release may take the form of visual inspection or oral or written exchange of information. *See* 15 C.F.R. § 734.15(a). If such a release or transfer is made abroad to a foreign person of a country other than the country where the release occurs, it is considered a deemed re-export to the foreign person's most recent country of citizenship or permanent residency. *See* 15 C.F.R. § 734.14(a)(2). Licenses from DOC may be required for deemed exports or re-exports. An act causing the release of export-controlled items to a foreign person (e.g., providing or using an access key or code) may require authorization from DOC to the same extent that an export or re-export of such items to the foreign person would. *See* 15 C.F.R. § 734.15(b).
4. The non-Federal entity must secure all export-controlled items that it possesses or that comes into its possession in performance of this financial assistance award, to ensure that the export of such items, including in the form of release or transfer to foreign persons, is prevented, or licensed, as required by applicable Federal laws, E.O.s, and/or regulations, including the EAR.
5. As applicable, non-Federal entity personnel and associates at DOC sites will be informed of any procedures to identify and protect export-controlled items from unauthorized export.

6. To the extent the non-Federal entity wishes to release or transfer export-controlled items to foreign persons, the non-Federal entity will be responsible for obtaining any necessary licenses, including licenses required under the EAR for deemed exports or deemed re-exports. Failure to obtain any export licenses required under the EAR may subject the non-Federal entity to administrative or criminal enforcement. See 15 C.F.R. part 764.
7. Nothing in the terms of this financial assistance award is intended to change, supersede, or waive the requirements of applicable Federal laws, E.O.s or regulations.
8. Compliance with this term will not satisfy any legal obligations the non-Federal entity may have regarding items that may be subject to export controls administered by other agencies such as the Department of State, which has jurisdiction over exports and re-exports of defense articles and services subject to the International Traffic in Arms Regulations (ITAR) (22 C.F.R. §§ 120-130), including the release of defense articles to foreign persons in the United States and abroad.
9. The non-Federal entity must include the provisions contained in this term in all lower tier transactions (subawards, contracts, and subcontracts) under this financial assistance award that may involve research or other activities that implicate export-controlled items.

n. The Trafficking Victims Protection Act of 2000 (22 U.S.C. § 7104(g)), as amended, and the implementing regulations at 2 C.F.R. Part 175

The Trafficking Victims Protection Act of 2000 authorizes termination of financial assistance provided to a private entity, without penalty to the Federal Government, if any non-Federal entity engages in certain activities related to trafficking in persons. The DOC hereby incorporates the following award term required by 2 C.F.R. § 175.15(b):

Trafficking in persons.

a. Provisions applicable to a recipient that is a private entity.

1. *You as the recipient, your employees, subrecipients under this award, and subrecipients' employees may not—*
 - i. *Engage in severe forms of trafficking in persons during the period of time that the award is in effect;*
 - ii. *Procure a commercial sex act during the period of time that the award is in effect; or*
 - iii. *Use forced labor in the performance of the award or subawards under the award.*

2. We as the Federal awarding agency may unilaterally terminate this award, without penalty, if you or a subrecipient that is a private entity —

i. Is determined to have violated a prohibition in paragraph a.1 of this award term; or

ii. Has an employee who is determined by the agency official authorized to terminate the award to have violated a prohibition in paragraph a.1 of this award term through conduct that is either— (A) Associated with performance under this award; or (B) Imputed to you or the subrecipient using the standards and due process for imputing the conduct of an individual to an organization that are provided in 2 C.F.R. Part 180 (OMB Guidelines to Agencies on Governmentwide Debarment and Suspension – Nonprocurement), as implemented by DOC at 2 C.F.R. Part 1326 (Nonprocurement Debarment and Suspension).

b. Provision applicable to a recipient other than a private entity. We as the Federal awarding agency may unilaterally terminate this award, without penalty, if a subrecipient that is a private entity—

1. Is determined to have violated an applicable prohibition in paragraph a.1 of this award term; or

2. Has an employee who is determined by the agency official authorized to terminate the award to have violated an applicable prohibition in paragraph a.1 of this award term through conduct that is either—

i. Associated with performance under this award; or

ii. Imputed to the subrecipient using the standards and due process for imputing the conduct of an individual to an organization that are provided in 2 C.F.R. Part 180 (OMB Guidelines to Agencies on Governmentwide Debarment and Suspension – Nonprocurement), as implemented by DOC at 2 C.F.R. Part 1326, (Nonprocurement Debarment and Suspension).

c. Provisions applicable to any recipient.

1. You must inform us immediately of any information you receive from any source alleging a violation of a prohibition in paragraph a.1 of this award term.

2. Our right to terminate unilaterally that is described in paragraph a.2 or b of this section:

i. Implements section 106(g) of the Trafficking Victims Protection Act of 2000 (TVPA), as amended (22 U.S.C. 7104(g)), and

ii. Is in addition to all other remedies for noncompliance that are available to us under this award.

3. You must include the requirements of paragraph a.1 of this award term in any subaward you make to a private entity.

d. Definitions. For purposes of this award term:

1. “Employee” means either:

i. An individual employed by you or a subrecipient who is engaged in the performance of the project or program under this award; or

ii. Another person engaged in the performance of the project or program under this award and not compensated by you including, but not limited to, a volunteer or individual whose services are contributed by a third party as an in-kind contribution toward cost sharing or matching requirements.

2. “Forced labor” means labor obtained by any of the following methods: the recruitment, harboring, transportation, provision, or obtaining of a person for labor or services, through the use of force, fraud, or coercion for the purpose of subjection to involuntary servitude, peonage, debt bondage, or slavery.

3. “Private entity”:

i. Means any entity other than a State, local government, Indian tribe, or foreign public entity, as those terms are defined in 2 C.F.R. § 175.25;

ii. Includes: (A) A nonprofit organization, including any nonprofit institution of higher education, hospital, or tribal organization other than one included in the definition of Indian tribe at 2 C.F.R. § 175.25(b); and (B) A for-profit organization.

4. “Severe forms of trafficking in persons,” “commercial sex act,” and “coercion” have the meanings given at section 103 of the TVPA, as amended (22 U.S.C. § 7102).

o. The Federal Funding Accountability and Transparency Act (FFATA) (31 U.S.C. § 6101 note)

1. **Reporting Subawards and Executive Compensation.** Under FFATA, recipients of financial assistance awards of \$30,000 or more are required to report periodically on executive compensation and subawards, as described in the following term from 2 C.F.R. Part 170, Appendix A, which is incorporated into this award:

Reporting Subawards and Executive Compensation

a. Reporting of first-tier subawards.

1. *Applicability.* Unless you are exempt as provided in paragraph d. of this award term, you must report each action that equals or exceeds \$30,000 in Federal funds for a subaward

to a non-Federal entity or Federal agency (see definitions in paragraph e. of this award term).

2. *Where and when to report.*

- i. You must report each obligating action described in paragraph a.1. of this award term to <http://www.fsrs.gov>.
- ii. For subaward information, report no later than the end of the month following the month in which the obligation was made. (For example, if the obligation was made on November 7, 2010, the obligation must be reported by no later than December 31, 2010.)

3. *What to report.* You must report the information about each obligating action that the submission instructions posted at <http://www.fsrs.gov> specify.

b. Reporting Total Compensation of Recipient Executives for non-Federal entities.

1. *Applicability and what to report.* You must report total compensation for each of your five most highly compensated executives for the preceding completed fiscal year, if—

- i. the total Federal funding authorized to date under this Federal award equals or exceeds \$30,000 as defined in 2 C.F.R. § 170.320;

- ii. in the preceding fiscal year, you received—

(A) 80 percent or more of your annual gross revenues from Federal procurement contracts (and subcontracts) and Federal financial assistance subject to the Transparency Act, as defined at 2 C.F.R. § 170.320 (and subawards), and

(B) \$25,000,000 or more in annual gross revenues from Federal procurement contracts (and subcontracts) and Federal financial assistance subject to the Transparency Act, as defined at 2 C.F.R. § 170.320 (and subawards); and,

- iii. The public does not have access to information about the compensation of the executives through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. § 78m(a), 78o(d)) or section 6104 of the Internal Revenue Code of 1986. (To determine if the public has access to the compensation information, see the U.S. Security and Exchange Commission total compensation filings at <http://www.sec.gov/answers/execomp.htm>.)

2. *Where and when to report.* You must report executive total compensation described in paragraph b.1. of this award term:

- i. As part of your registration profile found at the System for Award Management (SAM) website located at <https://www.sam.gov>.

- ii. By the end of the month following the month in which this award is made, and annually thereafter.

c. Reporting of Total Compensation of Subrecipient Executives.

1. *Applicability and what to report.* Unless you are exempt as provided in paragraph d. of this award term, for each first-tier non-Federal entity subrecipient under this award, you shall report the names and total compensation of each of the subrecipient's five most highly compensated executives for the subrecipient's preceding completed fiscal year, if—

- i. in the subrecipient's preceding fiscal year, the subrecipient received—

- (A) 80 percent or more of its annual gross revenues from Federal procurement contracts (and subcontracts) and Federal financial assistance subject to the Transparency Act, as defined at 2 C.F.R. § 170.320 (and subawards) and,

- (B) \$25,000,000 or more in annual gross revenues from Federal procurement contracts (and subcontracts), and Federal financial assistance subject to the Transparency Act (and subawards); and

- ii. The public does not have access to information about the compensation of the executives through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m(a), 78o(d)) or section 6104 of the Internal Revenue Code of 1986. (To determine if the public has access to the compensation information, see the U.S. Security and Exchange Commission total compensation filings at <http://www.sec.gov/answers/execomp.htm>).

See also 2 C.F.R. § 200.300(b).

2. *Where and when to report.* You must report subrecipient executive total compensation described in paragraph c.1. of this award term:

- i. To the recipient.

- ii. By the end of the month following the month during which you make the subaward. For example, if a subaward is obligated on any date during the month of October of a given year (i.e., between October 1 and 31), you must report any required compensation information of the subrecipient by November 30 of that year.

d. Exemptions. If, in the previous tax year, you had gross income, from all sources, under \$300,000, you are exempt from the requirements to report: i. Subawards, and ii. The total compensation of the five most highly compensated executives of any subrecipient.

e. **Definitions.** For purposes of this award term:

1. *Federal Agency means a Federal agency as defined at 5 U.S.C. 551(1) and further clarified by 5 U.S.C. 552(f).*
2. *Non-Federal entity means all of the following, as defined in 2 C.F.R. Part 25:*
 - i. *A Governmental organization, which is a State, local government, or Indian tribe;*
 - ii. *A foreign public entity;*
 - iii. *A domestic or foreign nonprofit organization; and,*
 - iv. *A domestic or foreign for-profit organization.*
3. *Executive means officers, managing partners, or any other employees in management positions.*
4. *Subaward:*
 - i. *This term means a legal instrument to provide support for the performance of any portion of the substantive project or program for which you received this award and that you as the recipient award to an eligible subrecipient.*
 - ii. *The term does not include your procurement of property and services needed to carry out the project or program (for further explanation, see 2 C.F.R § 200.331).*
 - iii. *A subaward may be provided through any legal agreement, including an agreement that you or a subrecipient considers a contract.*
5. *Subrecipient means a non-Federal entity or Federal agency that:*
 - i. *Receives a subaward from you (the recipient) under this award; and*
 - ii. *Is accountable to you for the use of the Federal funds provided by the subaward.*
6. *Total compensation means the cash and noncash dollar value earned by the executive during the recipient's or subrecipient's preceding fiscal year and includes the following (for more information see 17 C.F.R. § 229.402(c)(2)):*
 - i. *Salary and bonus.*
 - ii. *Awards of stock, stock options, and stock appreciation rights. Use the dollar amount recognized for financial statement reporting purposes with respect to the fiscal year in accordance with the Statement of Financial Accounting Standards No. 123 (Revised 2004) (FAS 123R), Shared Based Payments.*

- iii. *Earnings for services under non-equity incentive plans. This does not include group life, health, hospitalization or medical reimbursement plans that do not discriminate in favor of executives, and are available generally to all salaried employees.*
- iv. *Change in pension value. This is the change in present value of defined benefit and actuarial pension plans.*
- v. *Above-market earnings on deferred compensation which is not tax-qualified.*
- vi. *Other compensation, if the aggregate value of all such other compensation (e.g. severance, termination payments, value of life insurance paid on behalf of the employee, perquisites or property) for the executive exceeds \$10,000.*

2. **System for Award Management (SAM) and Universal Identifier Requirements** -- as described in 2 C.F.R. Part 25, Appendix A, which is incorporated into this award:

System for Award Management (SAM) and Universal Identifier Requirements

a. ***Requirement for System for Award Management.*** Unless you are exempted from this requirement under 2 C.F.R. § 25.110, you as the recipient must maintain current information in the SAM. This includes information on your immediate and highest level owner and subsidiaries, as well as on all of your predecessors that have been awarded a Federal contract or Federal financial assistance within the last three years, if applicable, until you submit the final financial report required under this Federal award or receive the final payment, whichever is later. This requires that you review and update the information at least annually after the initial registration, and more frequently if required by changes in your information or another Federal award term.

b. ***Requirement for Unique Entity Identifier.*** If you are authorized to make subawards under this Federal award, you:

- 1. *Must notify potential subrecipients that no entity (see definition in paragraph c of this award term) may receive a subaward from you until the entity has provided its Unique Entity Identifier to you.*
- 2. *May not make a subaward to an entity unless the entity has provided its Unique Entity Identifier to you. Subrecipients are not required to obtain an active SAM registration, but must obtain a Unique Entity Identifier.*

c. ***Definitions for purposes of this term:***

- 1. *SAM means the Federal repository into which a recipient must provide information required for the conduct of business as a recipient. Additional information about registration procedures may be found at the SAM Internet site (currently at <https://www.SAM.gov>).*

2. *Unique Entity Identifier means the identifier assigned by SAM to uniquely identify business entities.*
3. *Entity includes non-Federal entities as defined at 2 C.F.R. § 200.1 and also includes all of the following, for purposes of this part:*
 - i. *A foreign organization;*
 - ii. *A foreign public entity;*
 - iii. *A domestic for-profit organization; and*
 - iv. *A Federal agency.*
4. *Subaward has the meaning given in 2 C.F.R § 200.1.*
5. *Subrecipient has the meaning given in 2 C.F.R § 200.1.*

See also 2 C.F.R. § 200.300(b).

p. Recipient Integrity and Performance Matters (Appendix XII to 2 C.F.R. Part 200)

Reporting of Matters Related to Recipient Integrity and Performance

1. **General Reporting Requirement.** If the total value of your currently active grants, cooperative agreements, and procurement contracts from all Federal awarding agencies exceeds \$10,000,000 for any period of time during the period of performance of this Federal award, then you as the recipient during that period of time must maintain the currency of information reported to the System for Award Management (SAM) that is made available in the designated integrity and performance system (currently the Federal Awardee Performance and Integrity Information System (FAPIIS)) about civil, criminal, or administrative proceedings described in paragraph 2 of this award term and condition. This is a statutory requirement under section 872 of Public Law 110-417, as amended (41 U.S.C. 2313). As required by section 3010 of Public Law 111-212, all information posted in the designated integrity and performance system on or after April 15, 2011, except past performance reviews required for Federal procurement contracts, will be publicly available.
2. **Proceedings About Which You Must Report.** Submit the information required about each proceeding that:
 - i. Is relating to the award or performance of a grant, cooperative agreement, or procurement contract from the Federal Government;
 - ii. Reached its final disposition during the most recent five-year period; and

iii. Is one of the following:

- (A) A criminal proceeding that resulted in a conviction, as defined in paragraph 5 of this award term and condition;
- (B) A civil proceeding that resulted in a finding of fault and liability and payment of a monetary fine, penalty, reimbursement, restitution, or damages of \$5,000 or more;
- (C) An administrative proceeding, as defined in paragraph 5 of this award term and condition, that resulted in a finding of fault and liability and your payment of either a monetary fine or penalty of \$5,000 or more or reimbursement, restitution, or damages in excess of \$100,000; or
- (D) Any other criminal, civil, or administrative proceeding if:
 - I. It could have led to an outcome described in paragraph 2.c.(1), (2), or (3) of this award term and condition;
 - II. It had a different disposition arrived at by consent or compromise with an acknowledgment of fault on your part; and
 - III. The requirement in this award term and condition to disclose information about the proceeding does not conflict with applicable laws and regulations.

3. Reporting Procedures. Enter in the SAM Entity Management area the information that SAM requires about each proceeding described in paragraph 2 of this award term and condition. You do not need to submit the information a second time under assistance awards that you received if you already provided the information through SAM because you were required to do so under Federal procurement contracts that you were awarded.

4. Reporting Frequency. During any period when you are subject to the requirement in paragraph 1 of this award term and condition, you must report proceedings information through SAM for the most recent five-year period, either to report new information about any proceeding(s) that you have not reported previously or affirm that there is no new information to report. Recipients that have Federal contract, grant, and cooperative agreement awards with a cumulative total value greater than \$10,000,000 must disclose semiannually any information about the criminal, civil, and administrative proceedings.

5. Definitions. For purposes of this award term and condition:

- i. Administrative proceeding means a non-judicial process that is adjudicatory in nature to make a determination of fault or liability (e.g., Securities and Exchange Commission Administrative proceedings, Civilian Board of Contract Appeals proceedings, and Armed Services Board of Contract Appeals proceedings). This includes proceedings at the Federal and State level but only in connection with performance of a Federal contract or grant. It does not include audits, site visits, corrective plans, or inspection of deliverables.

ii. Conviction, for purposes of this award term and condition, means a judgment or conviction of a criminal offense by any court of competent jurisdiction, whether entered upon a verdict or a plea, and includes a conviction entered upon a plea of nolo contendere.

iii. Total value of currently active grants, cooperative agreements, and procurement contracts includes:

(A) Only the Federal share of the funding under any Federal award with a recipient cost share or match; and

(B) The value of all expected funding increments under a Federal award and options, even if not yet exercised.

q. Never Contract with the Enemy (2 C.F.R Part 183; 2 C.F.R. § 200.215)

Under 2 C.F.R. § 200.215 (Never contract with the enemy) Federal awarding agencies and recipients are subject to the regulations implementing Never Contract with the Enemy in 2 C.F.R. Part 183. These regulations affect covered contracts, grants and cooperative agreements that are expected to exceed \$50,000 within the period of performance, are performed outside the United States and its territories, and are in support of a contingency operation in which members of the Armed Forces are actively engaged in hostilities.

1. **Applicability.** This term applies only to recipients of covered grants or cooperative agreements, as defined in 2 C.F.R. § 183.35 Definitions.

2. **Requirements.** As applicable, recipients must fulfill the requirements as described in the following terms from 2 C.F.R. Part 183, Appendix A, which is incorporated into this award:

a. Term 1. Prohibition on Providing Funds to the Enemy.

1. *The recipient must—*

- i. Exercise due diligence to ensure that none of the funds, including supplies and services, received under this grant or cooperative agreement are provided directly or indirectly (including through subawards or contracts) to a person or entity who is actively opposing the United States or coalition forces involved in a contingency operation in which members of the Armed Forces are actively engaged in hostilities, which must be completed through 2 CFR Part 180.300 prior to issuing a subaward or contract and;*
- ii. Terminate or void in whole or in part any subaward or contract with a person or entity listed in SAM as a prohibited or restricted source pursuant to subtitle E of Title VIII of the NDAA for FY 2015, unless the Federal awarding agency provides written approval to continue the subaward or contract.*

2. *The recipient may include the substance of this clause, including this paragraph (1), in subawards under this grant or cooperative agreement that have an estimated value over \$50,000 and will be performed outside the United States, including its outlying areas.*

3. *The Federal awarding agency has the authority to terminate or void this grant or cooperative agreement, in whole or in part, if the Federal awarding agency becomes aware that the recipient failed to exercise due diligence as required by paragraph (1) of this clause or if the Federal awarding agency becomes aware that any funds received under this grant or cooperative agreement have been provided directly or indirectly to a person or entity who is actively opposing coalition forces involved in a contingency operation in which members of the Armed Forces are actively engaged in hostilities*

b. Term 2. Additional Access to Recipient Records.

1. *In addition to any other existing examination-of-records authority, the Federal Government is authorized to examine any records of the recipient and its subawards or contracts to the extent necessary to ensure that funds, including supplies and services, available under this grant or cooperative agreement are not provided, directly or indirectly, to a person or entity that is actively opposing United States or coalition forces involved in a contingency operation in which members of the Armed Forces are actively engaged in hostilities, except for awards awarded by the Department of Defense on or before Dec 19, 2017 that will be performed in the United States Central Command (USCENTCOM) theater of operations*

2. *The substance of this clause, including this paragraph (2), is required to be included in subawards or contracts under this grant or cooperative agreement that have an estimated value over \$50,000 and will be performed outside the United States, including its outlying areas.*

r. Prohibition on certain telecommunications and video surveillance services or equipment (Public Law 115-232, section 889; 2 C.F.R. § 200.216)

(a) Recipients and subrecipients are prohibited from obligating or expending loan or grant funds to:

- (1) Procure or obtain,
- (2) Extend or renew a contract to procure or obtain, or
- (3) Enter into a contract (or extend or renew a contract) to procure or obtain equipment, services or systems that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system.

As described in Public Law 115-232, section 889, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).

- (i). For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).
- (ii). Telecommunications or video surveillance services provided by such entities or using such equipment.
- (iii). Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.

(b) In implementing the prohibition under Public Law 115-232, section 889, subsection (f), paragraph (1), heads of executive agencies administering loan, grant, or subsidy programs shall prioritize available funding and technical support to assist affected businesses, institutions and organizations as is reasonably necessary for those affected entities to transition from covered communications equipment and services, to procure replacement equipment and services, and to ensure that communications service to users and customers is sustained.

(c) See Public Law 115-232, section 889 for additional information.

(d) See also §200.471.

s. Federal Financial Assistance Planning During a Funding Hiatus or Government Shutdown

This term sets forth initial guidance that will be implemented for Federal assistance awards in the event of a lapse in appropriations, or a government shutdown. The Grants Officer may issue further guidance prior to an anticipated shutdown.

1. Unless there is an actual rescission of funds for specific grant or cooperative agreement obligations, non-Federal entities under Federal financial assistance awards for which funds have been obligated generally will be able to continue to perform and incur allowable expenses under the award during a funding hiatus. Non-Federal entities are advised that ongoing activities by Federal employees involved in grant or cooperative agreement administration (including payment processing) or similar operational and administrative work cannot continue when there is a funding lapse. Therefore, there may be delays, including payment processing delays, in the event of a shutdown.

2. All award actions will be delayed during a government shutdown; if it appears that a non-Federal entity's performance under a grant or cooperative agreement will require agency involvement, direction, or clearance during the period of a possible government shutdown, the Program Officer or Grants Officer, as appropriate, may attempt to provide such involvement, direction, or clearance prior to the shutdown or advise non-Federal entities that such involvement, direction, or clearance will not be forthcoming during the shutdown. Accordingly, non-Federal entities whose ability to withdraw funds is subject to prior agency approval, which in general are non-Federal entities that have been designated high risk, non-Federal entities under construction awards, or are otherwise limited to reimbursements or subject to agency review, will be able to draw funds down from the relevant Automatic Standard Application for Payment (ASAP) account only if agency approval is given and coded into ASAP prior to any government shutdown or closure. This limitation may not be lifted during a government shutdown. Non-Federal entities should plan to work with the Grants Officer to request prior approvals in advance of a shutdown wherever possible. Non-Federal entities whose authority to draw down award funds is restricted may decide to suspend work until the government reopens.
3. The ASAP system should remain operational during a government shutdown. Non-Federal entities that do not require any Grants Officer or agency approval to draw down advance funds from their ASAP accounts should be able to do so during a shutdown. The 30-day limitation on the drawdown of advance funds will still apply notwithstanding a government shutdown (see section B.02.b.1 of these terms).

Instructions for Submitting Build America Buy America Act Certifications

The Made in America Office of the OMB has established evidentiary recommendations to substantiate compliance with BABAA. The following instructions present those requirements allowing the designated parties to provide tailored certifications of their compliance to the specifics of the iron, steel, manufactured products, or construction materials under consideration.

INSTRUCTIONS FOR SUBMITTING A BABAA COMPLIANCE CERTIFICATION

Notes to User: Following are instructions to enable the "Contractor," "Subcontractor," "Seller," Or "Material Supplier," to produce a valid certification of compliance with Build America, Buy America Act domestic preference requirements. A certification should be provided to the Owner and Agency.

The following are to be carried out by an individual(s) with the necessary knowledge of the composition, fabrication and pricing of all Iron, Steel, Manufactured Products, and Construction Materials installed on the project.

BABAA Compliance Certification Checklist:

Step 1: Preparation

The "Contractor," "Subcontractor," "Seller," Or "Material Supplier," should collect country-of-origin information on all the materials and components of products. For those elements and items not satisfying the BABAA requirement, separate requests for BABAA waivers must be submitted.

Step 2: Assemble the Data

Create a table containing the country-of-origin for all materials and components of products employed in the project. Immediately below the material and product country-of-origin table, place the authorized and knowledgeable individual(s) signatory space and date over their printed name(s). Below each signature should appear the title of the certifying individual(s), the company's name, and the contact information including a telephone number and email address at which the individual(s) may be reached.

Step 3: Documentation

Prepare a document, either paper or electronic, on the letterhead of the company titled "BABAA Compliance Certification". Include the RUS project designation in the second line. Then insert the following statement:

I hereby certify that to the best of my knowledge and belief all Iron, Steel, Manufactured Products, and Construction Materials installed on this project by my company and by any and all subcontractors and

suppliers for this project comply with the Build America, Buy America Act (BABAA) requirements of the Infrastructure Investment and Jobs Act of 2021 (Pub. L. 117- 58, §§ 70901-70953), or are the subject of a waiver approved by the Secretary of Agriculture or designee.

Step 4: Compilation

The information tabulated in step 2, Assemble the Data, for all materials and components of products employed in the project should then be inserted.

Step 5: Certifying

After compiling all information and documentation, each certifying individual(s) provides wet signature and date.
