Project Manual For:

Central Maine Community College
Healthcare Training Expansion

Auburn, ME

Construction Documents

LBA Project # 25-061-00 / BGS Project # 3831

24 April 2026

LAVALLEE | BRENSINGER ARCHITECTS

Boston | Manchester | Portland

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PROJECT DIRECTORY

OWNER

Central Maine Community College
1250 Turner Street, Auburn, Maine 04210
Telephone: (207) 755-5284 Email: nhamel@mainecc.edu
Contact: Nick Hamel, Project Manager

ARCHITECT

Lavallee Brensinger Architects (LBA)
155 Dow St. #400, Manchester, New Hampshire 03101
Telephone: (207) 558-7202 Email: michael.murphy@lbpa.com
Contact: Michael Murphy, Project Manager

INTERIOR DESIGNER

Lavallee Brensinger Architects (LBA)
155 Dow St. #400, Manchester, New Hampshire 03101
Telephone: (207) 558-7200 Email: renee.bissonnette@lbpa.com
Contact: Renée Bissonette, 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

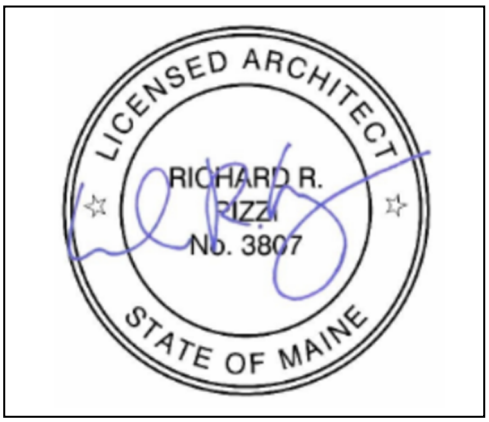
FIRE PROTECTION, PLUMBING, MECHANICAL, ELECTRICAL ENGINEERS

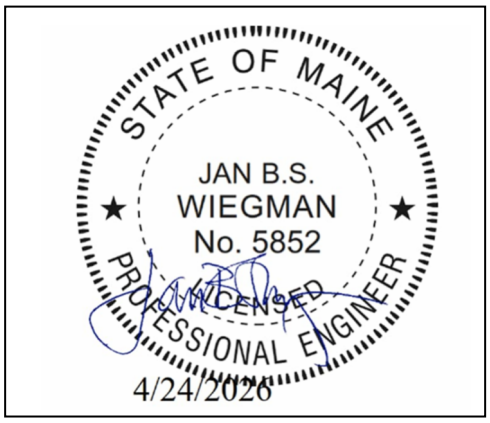
Salas O'Brien
160 Veranda Street, Portland, ME 04103
Telephone: (207) 221-2260 Email: Kenneth.Coley@salasobrien.com
Contact: Ken Coley, Vice President / Mechanical Department Manager

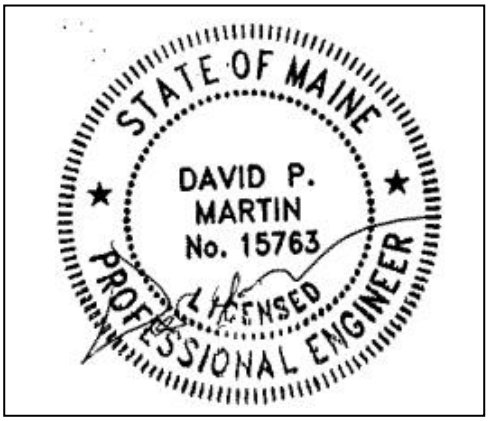
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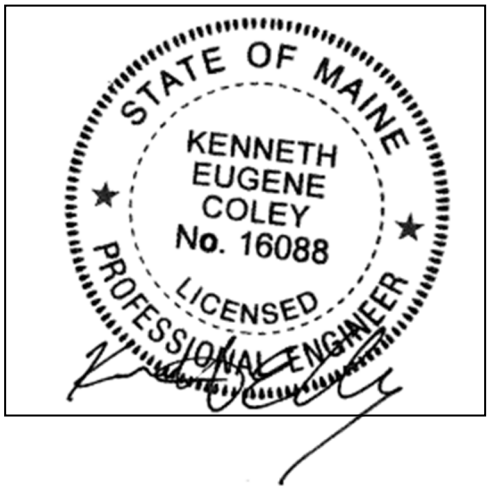
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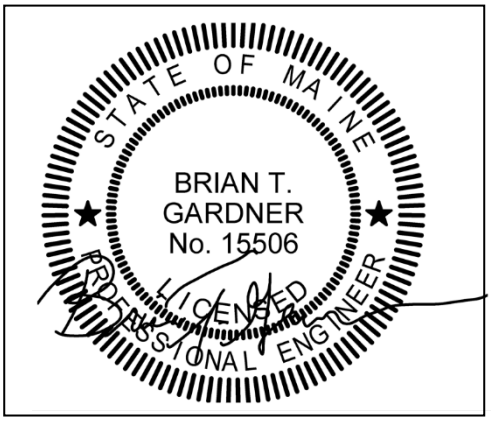
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00 11 13
Notice to Contractors

CMCC - Healthcare Training Expansion BGS# 3831

Central Maine Community College Healthcare Training Expansion: The project includes a two story addition with healthcare simulation space on the upper floor.

The contract shall designate the Substantial Completion Date on or before *01 July 2027*, and the Contract Final Completion Date on or before *29 September 2027*.

1. Bids shall be submitted in sealed envelopes plainly marked "**Bid for CMCC – Healthcare Training Expansion**" and addressed to:
   Nicholas Hamel
   Central Maine Community College
   1250 Turner Street
   Auburn,. ME 04210

   The envelope shall contain a completed Contractor Bid Form (section 00 41 13), provided in the Bid Documents, and include bid security when required. The bids shall be received no later than **2:00:00 p.m.** on ***25 June 2026***.

   Bid submissions will be opened and read aloud at *the address shown above* at the time and date noted above.

   Any bid submitted 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. 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: Nicholas Hamel as indicated above, nhamel@mainecc.edu.

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 9 *June 2026*.

   Lavallee Brensinger Architects
   Michael Murphy
   Michael.murphy@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 <u>not</u> required on this project.

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.
   1:00 PM on 2 June 2026
   Kirk Hall
   Central Maine Community College
   1250 Turner Street
   Auburn,. ME 04210

   or
   ☐ An on-site pre-bid conference will not be conducted for this project.

9. Bid Documents – Drawings will be available on or about 23 May 2026 and may be obtained on-line via link below:
   BGS Website - https://www.maine.gov/dafs/bgs/business-opportunities

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.

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.

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

CMCC - Healthcare Training Expansion BGS# 3831

Bid Form submitted by: *paper documents only to address below*

Bid Administrator:

nhamel@mainecc.edu

Nicholas Hamel
Central Maine Community College
1250 Turner Street
Auburn, ME 04210

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 *CMCC - Healthcare Training Expansions* Project Manual dated *April 24, 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	*Debrief Room 206B, Control Rooms 206A & 206C*	$ _____ .00
2	*RTU Enclosure*	$ _____ .00
3	*Slab Moisture Abatement*	$ _____ .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.

SAMPLE

[Fillable bond forms may be downloaded from the Bureau of General Services website.]

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.

SAMPLE

[Fillable bond forms may be downloaded from the Bureau of General Services website.]

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.

SAMPLE

[Fillable bond forms may be downloaded from the Bureau of General Services website.]

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.

SAMPLE

[Fillable bond forms may be downloaded from the Bureau of General Services website.]

AdvantageME CT# _____

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	*$0.00*
Alternate Bid number and name or "no Alternates"	*$0.00*
Alternate Bid number and name or "no Alternates"	*$0.00*
Alternate Bid number and name or "no Alternates"	*$0.00*
Alternate Bid number and name or "no Alternates"	*$0.00*
Alternate Bid number and name or "no Alternates"	*$0.00*
Total Contract Amount	***$0.00***

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 _____.

SAMPLE

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.

SAMPLE

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"***

SAMPLE

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:**
Signature *Date* *insert name*	*Signature* *Date* *John Kenney, P.E.*
Project Manager/ Contract Administrator	*Director, Planning Design and Construction Division (PDCD)*

SAMPLE

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.*

SAMPLE

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***

SAMPLE

8.3 Drawings: ***note each sheet number and title***

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

SAMPLE

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

CONTRACTOR	**SUBCONTRACTOR**
(Signature) *(Date)* *name and title*	*(Signature)* *(Date)* *name and title*
name of contracting entity	*name of contractor company*

SAMPLE

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.

SAMPLE

[Fillable bond forms may be downloaded from the Bureau of General Services website.]

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.

SAMPLE

[Fillable bond forms may be downloaded from the Bureau of General Services website.]

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.

SAMPLE

[Fillable bond forms may be downloaded from the Bureau of General Services website.]

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.

SAMPLE

[Fillable bond forms may be downloaded from the Bureau of General Services website.]

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.

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*.

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

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;

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.

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

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.

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.

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.

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

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,

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.

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.

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.

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.

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.

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

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.

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

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

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

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

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.

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.

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.

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)

THIS DOCUMENT MUST BE CLEARLY POSTED AT ALL CONSTRUCTION SITES FUNDED IN PART WITH STATE FUNDS

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 Androscoggin County (other than 1 or 2 family homes)

Occupational Title	Minimum Wage	Minimum Benefit	Total
Brickmasons and Blockmasons	$33.00	$11.13	$44.13
Bulldozer Operator	$30.62	$5.38	$36.00
Carpenter	$30.01	$19.69	$49.70
Cement Masons and Concrete Finisher	$24.42	$2.52	$26.94
Construction and Maintenance Painters	$22.47	$1.84	$24.31
Construction Laborer	$18.66	$11.38	$30.04
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	$22.81	$7.62	$30.43
Electrical Power - Line Installer and Repairers	$57.50	$34.35	$91.85
Electricians	$38.74	$21.14	$59.88
Elevator Installers and Repairers	$74.17	$38.44	$112.61
Excavator Operator	$34.12	$6.49	$40.61
Fence Erectors	$30.90	$2.18	$33.08
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	$23.00	$1.37	$24.37
Heating and Air Conditioning and Refrigeration Mechanics and Installers	$36.59	$7.12	$43.71
Heavy and Tractor - Trailer Truck Drivers	$29.13	$3.98	$33.11
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	$25.00	$4.60	$29.60
Light Truck or Delivery Services Drivers	$26.79	$5.14	$31.93
Loading Machine and Dragline Operators	$29.71	$4.79	$34.50
Millwrights	$35.99	$10.52	$46.51
Mobile Heavy Equipment Mechanics - Except Engines	$30.67	$5.10	$35.77
Operating Engineers and Other Equipment Operators	$39.74	$3.67	$43.41
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	$32.94	$20.82	$53.76
Riggers	$27.16	$21.25	$48.41
Roofers	$24.86	$2.03	$26.89
Sheet Metal Workers	$30.22	$6.70	$36.92
Structural Iron and Steel Workers	$32.94	$25.00	$57.94
Tapers	$30.09	$2.12	$32.21
Telecommunications Equipment Installers and Repairers - Except Line Installers	$37.09	$10.21	$47.30
Telecommunications Line Installers and Repairers	$28.49	$5.29	$33.78
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
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.

A. The Architect and their consulting engineer’s scope of services and responsibilities excludes work related to asbestos, petroleum and petroleum by products, polychlorinated biphenyl and other toxic or hazardous substances. Therefore, the Architect shall have no responsibility for any consequences resulting from the investigation, discovery, detection, identification, presence, leakage, discharge, 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 PFAS, volatile organic compounds, petroleum products, bacteria, molds, fungus, asbestos or asbestos products, lead, radon, electro-magnetic frequency radiation or other radiation.

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. Since the Construction Documents are complementary, before starting each portion of the Work, the Contractor shall carefully study and compare the various Drawings and other Construction Documents relative to that portion of the Work, as well as the information furnished by the Owner, shall take field measurements of any existing conditions related to that portion of the Work and shall observe and document any conditions at the site affecting it. Before starting the Work, and at frequent intervals during the progress thereof, the Contractor shall carefully study and compare the Construction Documents with each other and with the information furnished by the Owner and shall at once report to the Architect any error, inconsistency or omission the Contractor may discover. If the Contractor proceeds with the Work without such notice to the Architect, having discovered such errors, inconsistencies or omissions, or if by reasonable study of the Construction Documents the Contractor should have discovered such, the Contractor shall bear all costs arising therefrom.
2. 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.
3. 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.
4. 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.
5. 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.
6. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for maintenance, service, and repair.
7. Make adequate provision to accommodate items scheduled for later installation.
8. Coordinate completion and clean-up of Work in preparation of Substantial Completion.
9. 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, alcoholic beverages, vaping, and impairment supplements shall be strictly prohibited on the Project site, or within sight of 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 reviewed documents and samples to be incorporated into the Work.
   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 other relevant contact information.
   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 sub-contractors. The Contractor shall employ a licensed field engineer or land surveyor to determine all lines and grades and to field verify existing site conditions and measurements indicated on the Drawings. The Contractor's responsibility includes but is not necessarily limited to levels, control points, base lines, on-site bench marks, reference points, siting of improvements, locations of components, fixtures, equipment, finishes, site improvements, etc.
   1. The Contractor shall be responsible to submit a certificate signed by land surveyor registered in the State in which the Project is located, hired by the Contractor, certifying that the location of new building lines (outside corners) and location and elevation of improvements comply with the Contract Documents.
   2. The Owner has generally identified on the existing conditions survey, existing topography, utilities, wetlands, control points, and property line corner stakes. Contractor shall confirm all existing control points.
   3. The Contractor shall provide to the Architect written documentation to verify all layout. Include any deviations from the Contract Documents. Do not start any Work affected by such deviations until reviewed by the Architect.
   4. The Contractor shall be responsible for costs of survey work including but not necessarily limited to establishing and protecting on–site benchmarks, replacement or relocation of bench marks, additional base lines or levels, reference points, location of site improvements, verification of existing building dimensions, layout and floor elevations. All discrepancies shall be reported to the Architect for clarification.
   5. The location of underground utilities and construction indicated as existing or provided by the Site Contractor are not guaranteed. Before beginning sitework, investigate and verify

the existence and location of underground utilities and other construction. Verify the location and invert elevation at point of connection of sanitary sewer, storm drainage, and water service piping, conduits, etc….

6. The Contractor shall maintain a surveyor's log of control and other survey work. Record deviations from required lines, and level, and advise the Architect when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected.
7. The Contractor shall carefully examine all existing buildings to be demolished, site features, 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, 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. Utilities: The Contractor shall send proper notices, make all necessary arrangements and perform all other services required for the removal or the care, protection and maintenance of all utilities, including, but not limited to, fire plugs (hydrants), electric, water, sewer, telegraph poles and wires, and all other items of this character above or below the ground, on and around the building site and off-site locations affected by the site-work. The Contractor is responsible for paying all costs related to the protection and modification of utility connections. Related services to any existing facilities shall not be disrupted without the prior approval of the Owner, and then only to the minimum extent required. The Contractor shall comply with the "Underground Utility Damage Prevention System" by notification to DIG SAFE SYSTEM of intent to excavate near or around any underground utility installations. The Contractor shall call DIG SAFE SYSTEM at least 72 working day hours in advance of starting any such excavation.

O. 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.

P. 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.

Q. 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.

R. 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.

S. Snow Removal: The Construction Manager shall be responsible for snow and ice removal within designated staging and contractor storage & lay-down areas.

T. 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.

U. Existing Materials and Equipment: See Section 01 60 00 - Product Requirements.

V. Shipping and Storage of Materials: See Section 01 60 00 - Product Requirements.

W. Owner Furnished Equipment: See Section 01 60 00 - Product Requirements.

X. 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.

Y. 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.
   2. The cost of the Work for separate trades and activities shall be further broken down by major systems, components, labor, materials, sub-subcontracts or other appropriate means in sufficient detail to facilitate continued evaluation of project progress.

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 requirements of the 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 Substantial Completion issued previously for Owner occupancy of designated portions of the Work. See Article regarding Final Payment of the Agreement and 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 "Payments & Completion" of the General Conditions.
    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 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 Contact 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.
   2. When a Construction Change Directive is issued using an agreed upon price or fixed price the Contractor shall proceed to expeditiously complete the work, whether the Contractor agrees with the price or not.

F. Change Order Procedures: Upon the Owner's approval of a Change Order Proposal or Request, the Architect will issue a Change Order for signatures of the Owner, the State, 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 Contract or subcontractors, or materials suppliers will only be considered if submitted prior to the receipt of Bids, in strict conformance with the Instructions to 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 Contact 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.

1.09 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.

B. The Contractor shall maintain at the site for the Owner one record copy of the Drawings, Specifications, Addenda, order and marked currently to record changes and selections made during construction, and in addition, reviewed Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and, along with reproducible copies as identified elsewhere in the Contract Documents, shall be delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

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.

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 CMCC – Healthcare Training Expansion. 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 4: Debrief Room 206B & Control Rooms 206A & 206C.
   1. Base Bid Description: No additional work in this area.
   2. Alternate Description: Provide work as described in the Drawings for “Alternate #4”.
   3. State the amount to be ADDED.

B. Alternate No 5: RTU Enclosure.
   1. Base Bid Description: No enclosure around roof top mechanical unit.
   2. Alternate Description: Add RTU supported equipment screen as specified in Section 10 82 13.
   3. State the amount to be ADDED.

C. Alternate No 6: Concrete Slab Moisture Barrier System, in event of failed moisture testing
   4. Base Bid Description: No additional requirements.
   5. Alternate Description: Provide cost of Concrete Slab Moisture Barrier System as specified in Section 09 05 61 – Common Work Results for Flooring Preparation, providing all components as require for installation of specified floor finishes.
   6. State the amount to be ADDED.

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 00 - Project Close-out: Project record documents.
C. Section 01 78 10 - Warranties.

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 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
   1. Project website shall be operated by the Contractor. Provide web site user licenses for use of Owner, Owner's Commissioning Agent, Architect and Architect's consultants. Provide software training to users as necessary. On completion of the Project, provide one complete archive copy of Project website files to the Owner and Architect in a digital storage format acceptable to the Owner and Architect. Utilize one of the following project website software packages under currently published licensing agreements: Autodesk Forma, Procore, or equivalent acceptable to Owner and Architect.
   2. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
   3. Contractor and Architect are required to use this service.
   4. It is Contractor's responsibility to submit documents in allowable format.
   5. Subcontractors, suppliers, and Architect's consultants are to be permitted to use the service at no extra charge.
   6. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
   7. Paper document transmittals will not be reviewed.
   8. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

B. Cost: The cost of the service is to be paid by Contractor; include the cost of the service in the Contract Sum.

C. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.

D. Project Closeout: Architect will determine when to terminate the service for the Project. The Contractor is responsible for obtaining archive copies of files for Owner.

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 REQUESTS FOR INFORMATION

A. Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified. All RFIs shall be submitted to the Architect through the Contractor.

B. Content of the RFI shall include the Project name and number, date, name of Contractor, RFI number, assigned sequentially, RFI subject, Specification Section number and paragraph number, as applicable, Drawing and detail number as applicable, field dimensions and conditions as applicable, Contractor's suggested resolution and any impact on time or cost, Contractor's signature. Attach any sketches, descriptions, photos or other information relevant to fully describe items needing interpretation.

C. RFI form shall be soft-ware generated including the above information and acceptable to the Architect.

D. Architect's Action: Architect will review each RFI, determine action required and respond. Allow (5) five working days for Architect's response to each RFI. Architect's action may include a request for additional information. If the Contractor believes the RFI response warrants a change in Contract Time or the Contract Sum, notify the Architect in writing within 10 days of receipt of the RFI response.

E. RFI Log: Prepare, maintain and submit an RFI log organized by RFI number. Submit log weekly. Include date RFI was submitted and date of Architect's response.

F. On receipt of Architect's action, update RFI log and distribute response to affected parties. Notify Architect within 7 days if Contractor disagrees with response.

3.06 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. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review. All significant construction activities shall be represented. Time duration shall be in weekly increments. If work is planned in phases, provide scheduling for each phase. Schedules shall be coordinated with Owner's on-going occupancy, as applicable.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Submit updated schedule with each Application for Payment.

3.07 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.

3.08 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.

3.09 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: Via project management software.
2. File Naming: Include project identification, date and time of view, and view identification.

3.10 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.

3.11 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.

3.12 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".

3.13 RECORD DRAWINGS

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

3.14 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).
   2. PFAS Analytical & Detection Only: ALL Product Manufacturers MUST PROVIDE the following written certification for ALL materials submitted inclusive of related accessories and components.
      a. (BABAA) Build America, Buy America Act Compliant
      b. PFAS Per- and Polyfluoroalkyl Substances Disclosure: PFOA (perfluorooctanoic acid) and PFOS (perfluorooctane sulfonic acid)

         Intent: Provide products and associated components that are “FREE” of such chemical agents. It is understood that some components utilize lubricants and/or other secondary components with minute levels of PFAS. Where a product cannot be considered PFAS FREE such component(s) shall submit written disclosures of elements containing such PFAS materials and quantities within for Owner and Architect Review and Approval prior to procurement.

3.15 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.

3.16 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.

3.17 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.

3.18 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.

3.19 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.

3.20 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.

3.21 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.

3.22 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. 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.

G. 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 teting 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

Project	**CMCC Healthcare Training Expansion**	
Location	1250 Turner Street Auburn, ME 04210	
Owner	Central Maine Community College 1250 Turner Street Auburn, ME 04210 Contact: Nick Hamel, Project Manager	Tel: 207-755-5284
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)	S.W. Cole Engineering, Inc. 286 Portland Road Grey, ME 02915	Tel: 207-657-2866
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.

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.

Construction Category	Page	Construction Category	Page
Structural Steel Framing	3	Earthwork	9
Shear Connectors	3	In-situ Bearing Strata	9
Steel Joist Framing	x	Controlled Fill	9
Steel Decking	4		
Cold Formed Metal Framing	5	Cast-In-Place Concrete	6-7
Fireproofing	10	Firestopping	11
Steel Stairs & Handrails/Guardrails	12	Masonry	8
Storefront	13		

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).

Construction Component	Page
Cold Formed Metal Framing	5
Steel Stairs & Handrails/Guardrails	12
Storefront	13

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:

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

Signature:_____

Firm: Foley Buhl Roberts & Associates, Inc.

Date: _____

Registered Design Professional in Responsible Charge:

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

Signature:_____

Firm: Lavallee Brensinger Architects

Date: _____

Steel Construction
(IBC 2021 Section 1705.2)
(Specification Sections 051200, 051226 & 053100)

Item	Tests / Inspections	Code, Standard, or Document Reference	Agency	Type of Inspection[1,2]	Frequency
1. Steel Construction QC Review	• Review Contractor's field quality control procedures. • Review frequency and scope of field testing and inspections.	Spec. Section 051200	SER	-	Each submittal
2. Fabricator and Erector Certifications	• Review AISC Certified Fabricator and AISC Certified Erector Submittals.	AISC (Fabricator) Certification Standard for Steel Building Structures (BU) and AISC Certified Steel Erector (CSE)	SER & TA	-	Each submittal
3. Steel Construction QC Review	• Review Contractor's field quality control procedures. • Review frequency and scope of field testing and inspections.	Spec. Section 051200	TA	Plant Visit	Review and observe each Fabricator's detailed fabrication and quality control procedures for material, bolting, welding, surface preparation, and shop painting. If applicable, review reports by the Fabricator's approved independent inspection or quality control agency. Conduct one (1) initial visit to the structural steel fabrication plant and at least one (1) additional plant visit during the fabrication period. Additional visits to the fabrication plant may be requested by the SER, if necessary.
4. Materials	• Review material certifications for conformance to Specifications.	AISC 360 A3.1 AISC 360 A3.3 & 3.4 Spec. Section 051200	SER & TA	-	Each submittal
5. Anchor Rod Survey	• Review Contractor's as-built survey.	Spec. Section 051200	SER	-	Each submittal
6. Anchor Rods	• Verify that all anchor rods have been properly tightened and have adequate fit-up.	ASTM F1554 AISC 360 M4 Spec. Section 051200	SER & TA	Periodic	All anchor rods
7. Bolting	• Verify bolt size and grade. • Test and inspect bolted connections.	AISC 360 A3.3 & M2.5 Spec. Section 051200 AISC Specification for Structural Joints Using A325 or A490 Bolts	TA	Periodic	All bolts
			SER	-	During aperiodic site visits
8. Welding	• Check welder qualifications. • Check weld identification markings. • Test and inspect welds.	AWS D1.1 Section 6 Spec. Section 051200	TA	<u>Continuous:</u> •Complete and partial penetration groove welds, •Multiple pass fillet welds, •Plug and slot welds •Single pass fillet welds >5/16" <u>Periodic:</u> •Fillet welds ≤ 5/16"	<u>At moment connections:</u> Visually inspect and test all welds by ultrasonic or radiographic methods. If for an individual welder, the rejection rate is demonstrated to be five (5) percent or less, the non-destructive testing rate may be reduced to twenty-five (25) percent for the individual welder. The evaluation of the welding shall be based on a sampling of at least forty (40) completed welds. <u>At all other welds:</u> Visually inspect all welds.
			SER	-	During aperiodic site visits

9. Shear Connectors	• Check against Construction Documents and latest approved shop drawings. • Inspect shear connectors for size, quantity, and location. • Test shear connectors for proper weld attachment.	AWS D1.1 Section 7 Construction Documents Spec. Section 051226	TA	Periodic	Test a minimum of 10% of shear connectors; if one or more fail, then test all shear connectors.
			SER	-	During aperiodic site visits

10. Structural Framing, Details, and Assemblies	• Check against Construction Documents and latest approved shop drawings.
	• Inspect for size, grade of steel, installation, and connection details.
	• Verify steel frame joint details including:
	  • Details such as bracing and stiffeners
	  • Moment connections
	  • Joint configurations and locations
	  • Preparation of faying surfaces
		Construction Documents Spec. Section 051200	TA	Periodic	All framing, details, and assemblies.

			SER	-	During aperiodic site visits
11. Expansion & Adhesive Anchors	• Review installation procedures for both mechanical anchors and adhesive anchors. • Verify that materials are suitable for job conditions.	ACI 318 Appendix D Anchor manufacturer's instructions	TA[3]	Periodic	All anchors
			SER	-	Each submittal
12. Steel Decking	• Verify gage, depth, and type. • Inspect placement, laps, welds, side lap attachments, and mechanical fasteners • Check welder qualifications.	SDI Steel Deck Design Manual AWS D1.3 Section 7 Construction Documents Spec. Section 053100	TA	Periodic	All decking and connections
			SER	-	During aperiodic site visits
13. Field Correction of Fabricated Items	• Review documentation of approved repairs and verify completion of repairs.	Construction Documents Spec. Section 051200	TA	As required, per above	Each repair
			SER	-	During aperiodic site visits

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

[2]Periodic 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.

[3]The initial installation of anchors into each type of material shall be witnessed by both the TA and the anchor manufacturer's technical representative to establish correct procedures for the remaining anchors that will be visually inspected by the TA. The initial installation into each type of material shall be load tested by the anchor manufacturer. Anchor inspections following the initial installations are to be visual inspections unless there are adverse conditions that warrant additional load tests.

Cold Formed Metal Framing Construction[3] (IBC 2021 Section 1705.12.2) (Specification Section 054000)					
Item	Tests / Inspections	Code, Standard, or Document Reference	Agency	Type of Inspection[1,2]	Frequency
1. Cold Formed Metal Exterior Wall Stud Backup Framing Design and Cold Formed Metal Roof Truss Design	• Review supplier's structural design of cold formed metal exterior wall stud backup framing and cold formed metal roof trusses.	Construction Documents Spec. Section 054000	SER	-	Each submittal
2. Materials Certification	• Review certification of materials.	AISI Cold Formed Steel Design Manual Construction Documents Spec. Section 054000	SER & TA	-	Each submittal
3. Installation of Cold Formed Metal Exterior Wall Stud Backup Framing and Cold Formed Metal Roof Trusses	• Inspect type, size, gauge, spacing and placement of cold formed metal exterior wall studs, connections, anchorage, bridging, accessories, etc. for conformance with the approved Shop Drawings and Contract Documents. • Inspect installation of cold formed metal roof trusses, connections, anchorage, bridging, bracing, accessories, etc.	AISI Cold Formed Steel Design Manual Construction Documents Spec. Section 054000	TA	Periodic	All locations
			SE	-	Once during performance of the work and once after completion of the work
			SER	-	During aperiodic site visits

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

[2]Periodic 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.

[3]Testing and inspection of light gauge steel exterior wall framing is not required by IBC 2018 but is recommended by the Design Team.

Concrete Construction
(IBC 2021 Section 1705.3)
(Specification Section 033000)

Item	Tests / Inspections	Code, Standard, or Document Reference	Agency	Type of Inspection[1,2]	Frequency
1. Cast in Place Concrete Construction QC Review	• Review Contractor's field quality control procedures. • Review frequency and scope of field testing and inspections.	Construction Documents Spec. Section 033000	SER	-	Each submittal
2. Mix Design	• Review mix designs prior to placement.	Construction Documents Spec. Section 033000	SER	-	Each submittal
	• Verify use of required mix design.	ACI 318, 1.3.2.A ACI 318, Chapter 4 ACI 318, 5.2-5.4	TA	-	Each concrete placement
3. Materials	• Review material certifications for conformance to Specifications.	Construction Documents Spec. Section 033000	SER & TA	-	Each submittal
4. Reinforcement Installation	• Use latest set of approved reinforcing bar shop drawings. • Inspect reinforcing for grade, size, quantity, spacing, lap lengths, bends, hooks, condition, and placement. • Verify adequate cover per specifications. • Confirm dowel installation for masonry and concrete, including embedment lengths.	ACI 318, 1.3.2.C ACI 318, 7.5	TA	Periodic	Each concrete placement
			SER	-	During aperiodic site visits
5. Anchor Rods	• Inspect anchor rods prior to and during placement of concrete.	ACI 318 1.3.2.C	TA	Continuous	All anchor rods
			SER	-	During periodic site visits
6. Formwork	• Inspect forms for cleanliness and for proper sizes/locations of concrete members.	ACI 318 6.1.1	TA	Periodic	Each concrete placement
			SER	-	During aperiodic site visits
7. Concrete Placement and Sampling of Fresh Concrete	• Review hot-weather and cold-weather placement procedures submitted by the Contractor.	ACI 305 ACI 306	SER	-	Each submittal
	• Verify conformance to Specifications including hot-weather and cold-weather placement procedures.	ACI 305 ACI 306	TA	-	Each concrete placement
	• Observe concrete placement operations. • Check that total water does not exceed amount in design mix.	ACI 318, 1.3.2.D ACI 318, 5.9-5.10	TA	Continuous	Each concrete delivery
			SER	-	During aperiodic site visits
	• Concrete Strength	ASTM C31, C39 & C172	TA	-	For each strength of concrete, each day, take four (4) 6"x12" cylinders or six (6) 4"x8" cylinders for the first placement up to 50 CY. Then take the same number of additional
	• Concrete Slump	ASTM C143			

	• Concrete Air Content	ASTM C231			cylinders for every 50 CY thereafter. Take sample from point of discharge and at time fresh concrete is placed. Concrete for each set of cylinders shall be from (1) representative sample of the entire batch.
	• Concrete Temperature	ASTM C1064			
9. Evaluation of Concrete Strength	• Test and evaluate in accordance with the Specifications.	Construction Documents Spec. Section 033000 ACI 214 ASTM C42	TA	-	If 6" test cylinders - (1) 7-day & (2) 28-day results. Hold (1) for 56-day results, as needed. If 4" test cylinders - (1) 7-day & (3) 28-day results. Hold (2) for 56-day results, as needed.
			SER	-	Each submittal
10. Curing and Protection	• Observe procedures for conformance to the Specifications.	Construction Documents Spec. Section 033000	TA	Periodic	Each concrete placement
			SER	-	During aperiodic site visits

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

[2]Periodic 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.

Masonry Construction (IBC 2021 Section 1705.4) (Specification Section 042000)					
Item	Tests / Inspections	Code, Standard, or Document Reference	Agency	Type of Inspection[1,2]	Frequency
1. Tests Submitted by Contractor for Masonry Units/ Assemblages	• Review mortar, grout, and prism tests submitted by Contractor.	Construction Documents Spec. Section 042000 ACI 530.1 Art. 1.5	SER	-	Each class of masonry unit and type of masonry assemblage.
2. Materials Certification	• Review masonry units, masonry veneers, precast masonry units, and mortar and grout materials.	Construction Documents Spec. Section 042000 ACI 530.1 Art. 1.4B	SER	-	Each submittal
	• For record and field verification		TA		In conjunction with related field visits
3. Testing & Evaluation of Mortar & Grout Strength	• Sample and test mortar and grout used in field for masonry construction.	Construction Documents Spec. Section 042000 ACI 530.1 Art. 1.4B	TA	-	For each type of mortar and grout, per every 5,000 square feet of wall surface area: test mortar per ASTM C780 test grout per ASTM C1019
	• Review test results for mortar and grout.		SER	-	Each report
4. Proportioning, Mixing, and Consistency of Mortar & Grout	• Observe field procedures for proportioning and mixing of the mortar and grout to be used in the masonry construction.	Construction Documents Spec. Section 042000 ACI 530.1 Art. 2.6	TA	Continuous	Once, for each type of grout, at the beginning of masonry construction
			SER	-	During aperiodic site visits
5. Masonry Installation	• Inspect and report on installation of masonry units for general configuration and placement.	Construction Documents Spec. Section 042000 ACI 530.1 Art. 3.3	TA	Periodic	All locations
			SER	-	During aperiodic site visits
6. Anchorage	• Inspect type, spacing, and placement of masonry anchors and ties.	ACI 530 Sections 1.2.2.e & 1.16.1	TA	Periodic	All locations
			SER	-	During aperiodic site visits
7. Grouting Operations	• Inspect cells of masonry units for cleanliness prior to grouting. Observe partial/full grouting procedures.	Construction Documents Spec. Section 042000 ACI 530.1 Art. 2.6B	TA	Continuous	All locations
			SER	-	During aperiodic site visits
8. Weather Protection	• Observe protection of masonry against cold and hot weather.	IBC Sections ACI 530.1 Articles 1.8C & 1.8D	SER		Each submittal
			TA	Periodic	Each masonry placement
10. Anchorage of Exterior Wall Masonry Veneer	• Inspect type, size, spacing, and placement of approved anchorage to adjacent back-up framing.	Construction Documents Spec. Section 042000 ACI 530 Section 1.2.2.e	TA	Periodic	All locations
			SER	-	Each submittal

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

[2]Periodic 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.

Soils (IBC 2018 Section 1705.6) (Specification Section 316613.13 and 320000)					
Item	Tests / Inspections	Code, Standard, or Document Reference	Agency	Type of Inspection[1,2]	Frequency
1. Excavation	• Review existing sub-soils and groundwater conditions during building excavation.	Construction Documents Spec. Sections 316613.13 and 320000	GE	Periodic	At each location
2. Bearing Strata & Rammed Aggregate Piers	• Review the in-situ bearing strata and rammed aggregate piers for footings and slabs cast on grade. • Verify rammed aggregate piers are extended to proper depth and have reached proper bearing material. • Survey locations and top and bottom of rammed aggregate piers for compliance with tolerances in Specification. • Perform rammed aggregate pier testing as specified in Specification.	Construction Documents Spec. Section 320000	GE	Periodic	At each location
3. Structural Fill	• Observe and test compacted structural fill.	Construction Documents Spec. Section 320000	TA	Continuous	At each location
4. Overexcavation	• Monitor the removal of existing unsuitable fill material from the proposed building footprint.	Construction Documents Spec. Section 310000	GE	Continuous	At each location
5. Frost Protection of Subgrade	• Review subgrade for depth of frost prior to installation of foundations and slabs on grade. • Review subgrade for depth of frost during construction for protection of in-place foundations and slabs on grade.	Construction Documents Spec. Section 320000	GE & TA	Periodic	At each location
6. Installation of Perimeter Drainage Systems	• Monitor installation of the perimeter drainage system	Construction Documents Spec. Section 310000	GE	Periodic	At each location
7. Field Conditions	• Review existing conditions, procedures and in-situ bearing strata for underpinning.	Construction Documents Spec. Section 314000	GE	Continuous	At each location
8. Concrete Placement	• Observe concrete placement operations for underpinning.	Construction Documents Spec. Sections 033000 & 314000	TA	Periodic	See Concrete Construction Requirements

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

[2]Periodic 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.

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 ASTM E605 ASTM E736	AOR	-	Each submittal
	• For record and use in field verification		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
3. Mastic and Intumescent Fire-resistant Coatings	• Inspect coatings applied to structural elements in accordance with AWCI 12-B, based on the fire-resistance design as designated in the Construction Documents.	IBC 1705.16 Spec. Section 078100 AWCI 12-B	AOR & TA	Periodic	At all locations

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

[2]Periodic 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.

Firestopping (IBC 2021 Section 1705.18) (Specification Section 07 84 00)					
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

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

[2]Periodic 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

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

[2]Periodic 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.

Aluminum Storefront **(Specification Section 08 43 13)**					
Item	Tests / Inspections	Code, Standard, or Document Reference	Agency	Type of Inspection[1,2]	Frequency
1. Aluminum Storefront	• Review supplier's structural design of system.	Construction Documents Spec. Section 084313	SER	-	Each submittal
2. Material Certification	• Review materials used.	Construction Documents Spec. Section 084313	SER	-	Each submittal
	• For record and use in field verification.		TA		In conjunction with related field visits
3. Installation of Glazed Aluminum Storefront	• Inspect type, size, gauge, spacing, and placement of members for conformance to the approved Storefront Shop Drawings and Construction Documents. • Inspect member-to-member connections and connections/ anchorage to adjacent steel/concrete/wood support elements.	Construction Documents Spec. Section 084313 Manufacturer's installation instructions	TA	Periodic	All locations
			SE	-	Once during performance of the work and once after completion of the work
1. Field Testing: Water Intrusion	• Operable Components: AAMA 502. • Fixed Components: AAMA 501.2.	Construction Documents Spec. Section 084313	CA	-	All locations

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

[2]Periodic 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. Internet Connections: Minimum of one; DSL modem or faster.
   3. 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 product 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. Document 00 21 13 - Instructions to Sub-bidders: Product options and substitution procedures prior to bid date.

B. Section 01 00 00 - General Requirements.

C. Section 01 30 00 – Administrative Requirements: Substitutions.

D. Section 01 40 00 - Quality Requirements: Product quality monitoring.

E. Section 01 74 19 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting packaging and substitutions.

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 Contract 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 Contact 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.

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 00 72 13 - General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.

B. 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 Services: 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 (By Owner)
7. Owner's Equipment Testing. (By Owner)
    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 Contactor 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 32 10
SUBSURFACE EXPLORATIONS

PART 1 - GENERAL

1.01 GEOTECHNICAL REPORT AND SAMPLES

A. Soils investigations (test borings) were conducted and a report prepared for the Owner by S.W. Cole Engineering, Inc. of Grey, Maine. This report, titled “Explorations and Geotechnical Engineering Services, Proposed Kirk Hall Addition, 1250 Turner Street, Auburn, Maine”, dated April 3, 2026, was provided for the use of the Architect and Engineers in the design of the Project. Part of the information contained in these documents is interpretive (not factual) and therefore Bidders shall make their own deductions of subsurface conditions which may affect methods or cost of construction. These reports have been attached at the end of this Section for convenience.

1.02 SUBSURFACE CONDITIONS

A. The Owner has explored subsurface conditions and authorized soil investigations on site.

B. Factual boring logs and laboratory test results, are part of the geotechnical report. The logs describe subsurface conditions encountered at the exploration locations at the time explorations were made. Actual subsurface conditions may vary between exploration locations. No warranties, expressed or implied, are made as to accuracy of subsurface information provided herein.

C. No warranty is made of the continuity of strata or material between the exploration locations. The stratification lines on the logs represent approximate boundaries between soil types. The actual transitions between soil types may be gradual.

D. Water level readings have been observed in the explorations at times and under conditions stated on the logs. It must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors not evident at the time of drilling when the measurements were made

E. Boring locations shown on the drawings are approximate only and the Owner and Architect, including their consultants, make no representations regarding correctness of such information.

F. Bidders shall make their own deductions of subsurface conditions which may affect methods or cost of construction. Bidders may, at their own expense, and upon application to the Owner, conduct additional subsurface testing.

1.03 USE OF DATA

A. The subsurface investigations were obtained by the Owner only for the Architect's use in design, and are not a part of the Construction Documents. It is understood that neither the Owner, Architect, nor their consultants shall be responsible for any interpretations or conclusions drawn there from by Bidders or the Contractor with regard to the interpretive data or geotechnical report. The Owner and Architect, including their consultants, claim no responsibility for or endorsement of any construction methods, means, or techniques which may be contained in or implied by the above referenced logs and report.

B. Bidders shall visit the site and familiarize themselves with all existing conditions. Prior to bidding, Bidders may make their own subsurface investigations to satisfy themselves as to site and subsurface conditions, but all such investigations shall be performed under time schedule and arrangements approved in advance by the Owner.

C. The Owner and Architect, including their consultants, cannot guarantee the continuity of subsurface conditions between test locations. The Owner and Architect, including their consultants, cannot guarantee the accuracy or completeness of related documents and reports.

D. The Contractor must interpret the subsurface data relying upon his own judgement and acknowledges that the Owner and Architect, including their consultants, shall not be responsible for any deduction, interpretation, or conclusion made by any Bidder or Contractor.

F. No claim for extra cost or extension of time resulting from the Bidder or Contractor's deductions, interpretations, or conclusions shall be allowed.

END OF SECTION

REPORT

25-2165 S

April 3, 2026

Explorations and Geotechnical Engineering Services

Proposed Kirk Hall Addition
1250 Turner Street
Auburn, Maine

Prepared For:
Central Maine Community College
Attention: Nicholas Hamel
1250 Turner Street
Auburn, ME 04210

Prepared By:
S. W. Cole Engineering, Inc.
286 Portland Road
Gray, ME 04039
T: 207-657-2866

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25-2165 S

April 3, 2026

Central Maine Community College
Attention: Nicholas Hamel
1250 Turner Street
Auburn, ME 04210

Subject: Explorations and Geotechnical Engineering Services
Proposed Kirk Hall Addition
1250 Turner Street
Auburn, Maine

Dear Nick:

In accordance with our Proposal, dated November 18, 2025, we have performed subsurface explorations for the subject project. This report summarizes our findings and geotechnical recommendations and its contents are subject to the limitations set forth in Appendix A.

1.0 INTRODUCTION

1.1 Scope and Purpose

The purpose of our services was to obtain subsurface information at the site in order to develop geotechnical recommendations relative to foundations and earthwork associated with the proposed construction. Our scope of services included test boring explorations, soils laboratory testing, a geotechnical analysis of the subsurface findings, and preparation of this report.

1.2 Site and Proposed Construction

The site is located at Kirk Hall at the Central Maine Community College campus in Auburn, Maine. Kirk Hall is an on-grade, two-story building reportedly supported on spread footing foundations. We understand project planning includes an approximate 2,000 SF, on-grade, two-story building addition in existing lawn and landscaped area on the southerly end of the building. Numerous underground utilities extend beneath the

site, including storm drain, sanitary sewer, electric, and communications. Existing grades are relatively flat and level, ranging from about elevation 288 to 290 feet (project datum). We anticipate finish grades will be within about 3 feet of existing grades, with finish floor elevation matching the existing building.

Proposed and existing site features are shown on the "Exploration Location Plan" attached in Appendix B.

2.0 EXPLORATION AND TESTING

2.1 Explorations

Three test borings (B-201 through B-203) were made at the site on January 16, 2025 by Seaboard Drilling, LLC working under subcontract to S. W. Cole Engineering, Inc. (S.W.COLE). The exploration locations were selected and established in the field by S.W.COLE using measurements from existing site features. The exploration locations were limited by the existing utilities and equipment access. The approximate exploration locations are shown on the "Exploration Location Plan" attached in Appendix B. Logs of the explorations and a key to the notes and symbols used on the logs are attached in Appendix C. The elevations shown on the logs were estimated based on topographic information shown on the "Exploration Location Plan".

2.2 Field Testing

The test borings were drilled using hollow-stem augers. The soils were sampled at 2 to 5 foot intervals using a split spoon sampler and Standard Penetration Testing (SPT) methods. SPT blow counts are shown on the logs.

2.3 Laboratory Testing

Soil samples obtained from the explorations were returned to our laboratory for further classification and testing. Moisture content test results are noted on the logs. The results of one grain size analysis are attached in Appendix D.

3.0 SUBSURFACE CONDITIONS

3.1 Soil and Bedrock

The test borings encountered a subsurface profile generally consisting of uncontrolled fill overlying native glacial outwash sands. The principal soils encountered at the explorations are summarized below. Refer to the attached boring logs for more detailed subsurface information.

Uncontrolled Fill: Underlying a thin surficial layer of topsoil, the borings encountered uncontrolled fill extending to depths ranging from about 10.5 to 13 feet below existing ground surface (bgs). The uncontrolled fill consisted of loose to medium dense, brown, dark brown, and gray-brown, sand with varying portions of silt and gravel. In borings B-201 and B-203, the uncontrolled fill also contained varying portions of rootlets, fibrous organics, and wood.

Glacial Outwash: Underlying the uncontrolled fill, the borings encountered native glacial outwash deposits of loose to medium dense brown and light brown sand with varying portions of silt. The borings were terminated in these deposits at depths of 22 feet bgs.

3.2 Groundwater

The soils encountered at the test borings were generally damp to moist from the ground surface. Saturated soils were encountered in the borings at depths of about 20 feet bgs. Groundwater may become perched in the uncontrolled fill encountered in the test borings. Long term groundwater information is not available. It should be anticipated that groundwater levels will fluctuate, particularly in response to periods of snowmelt and precipitation, as well as changes in site use.

4.0 EVALUATION AND RECOMMENDATIONS

4.1 General Findings

Based on the subsurface findings, the proposed construction appears feasible from a geotechnical standpoint. The principal geotechnical considerations include:

- The test borings encountered loose uncontrolled fill with organics extending to depths ranging from about 10.5 to 13 feet below existing ground surface. In our opinion, the uncontrolled fill is unsuitable for support of the proposed building addition without risk of adverse post-construction settlement. We have considered the following options to mitigate the unsuitable soils:

    - The uncontrolled fill could be removed from beneath the proposed building addition footprint and replaced with compacted Granular Borrow. However, considering the depth of the unsuitable soils, the overexcavation would extend deeper than the adjacent Kirk Hall foundations, requiring shoring and underpinning of the existing foundations. Therefore, this presents limitations from an economic standpoint.

    - Alternatively, we recommend the uncontrolled fill be improved with Aggregate Piers which extend through the uncontrolled fill and into the underlying native sand, to support conventional spread footing foundations and an on-grade floor slab. The ground improvement installation methods must consider minimizing vibrations which can adversely impact Kirk Hall; consideration should be given to pre-drilling to reduce vibration transmission to the existing buildings.

- Numerous underground utilities extend beneath the site, including stormdrain, sanitary sewer, electric, and communications. We recommend the existing utility structures and piping be removed from beneath the proposed building addition and backfilled with compacted Granular Borrow. Piping extending beyond the addition footprint must be properly abandoned and plugged to prevent soil migration.

- Following removal and backfilling of existing utilities and installation of aggregate pier ground improvement, spread footing foundations and a slab-on-grade floor bearing on properly prepared improved subgrades appear suitable for the proposed building. Footings should bear on at least 6-inches of compacted Crushed Stone overlying ground improvement with Aggregate Piers. On-grade floor slabs should bear on at least 12-inches of compacted Structural Fill overlying ground improved with Aggregate Piers.

- Earthwork and grading activities should occur during drier, non-freezing weather of Spring, Summer and Fall. Excavation of bearing surfaces should be completed with a smooth-edged bucket to lessen subgrade disturbance.

4.2 Site and Subgrade Preparation

We recommend that site preparation begin with the construction of an erosion control system to protect adjacent drainage ways and areas outside the construction limits. Surficial organics, roots and topsoil should be completely removed from areas of proposed fill and construction. As much vegetation and pavement as possible should remain outside the construction areas to lessen the potential for erosion and site disturbance.

We recommend the existing utility structures and piping be removed from beneath the proposed building addition and backfilled with compacted Granular Borrow. Piping extending beyond the addition footprint must be properly abandoned and plugged to prevent soil migration. Grades should be raised using compacted Granular Borrow.

As discussed, we recommend the uncontrolled fill be improved with Aggregate Piers beneath the proposed building footprint (including foundations, floor slabs, and entrance slabs). We recommend that footings be underlain by at least 6-inches of compacted Crushed Stone overlying ground improved with Aggregate Piers. We recommend that on-grade floor slabs be underlain by at least 12-inches of compacted Structural Fill overlying ground improved with Aggregate Piers. Final excavations to subgrade should be made using a smooth-edged bucket.

4.3 Excavation and Dewatering

Excavation work will generally encounter uncontrolled fills. Care must be exercised during construction to limit disturbance of the bearing soils. Earthwork and grading activities should occur during drier, non-freezing weather of Spring, Summer and Fall. Final cuts to subgrade should be performed with a smooth-edged bucket to help reduce strength loss from soil disturbance.

Vibrations from construction should be controlled below threshold limits of 0.5 in/sec for structures, water supply wells and infrastructure within 500 feet of the project site. More restrictive vibration limits may be warranted in specific cases with sensitive equipment, historic structures or artifacts on-site or within close proximity. We recommend existing

conditions surveys be completed on Kirk Hall and vibrations be monitored during construction.

Sumping and pumping dewatering techniques should be adequate to control groundwater in shallow excavations made above the groundwater table. Controlling the water levels to at least one foot below planned excavation depths will help stabilize subgrades during construction. Excavations must be properly shored or sloped in accordance with OSHA Regulations to prevent sloughing and caving of the sidewalls during construction. Care must be taken to preclude undermining adjacent structures, utilities and roadways. The design and planning of excavations, excavation support systems, and dewatering is the responsibility of the contractor.

4.4 Foundations

As presented herein, we recommend the proposed building be supported on spread footing foundations bearing on ground improved with Aggregate Piers. Spread footings should be founded on at least 6 inches of compacted Crushed Stone bearing on improved ground. For foundations bearing on properly prepared subgrades, we recommend the following geotechnical parameters for design consideration:

Geotechnical Parameters for Spread Footings on Improved Ground	
Design Frost Depth (100-year AFI)	4.5 feet
Net Allowable Soil Bearing Pressure (Improved Ground)	3.0 ksf
Base Friction Factor	0.4
Total Unit Weight of Backfill	125 pcf
At-Rest Lateral Earth Pressure Coefficient	0.5
Internal Friction Angle of Backfill	30°
Seismic Soil Site Class	D (IBC 2021)
Total Settlement (Improved Ground)	½-inch
Differential Settlement (Improved Ground)	½-inch

We recommend the contract documents require an engineered submittal for Aggregate Piers to improve ground conditions to meet or exceed the geotechnical parameters for bearing capacity and settlement as recommended herein. The Aggregate Pier submittal must include QC and modulus testing procedures. We recommend Aggregate Pier load testing be completed prior to installing production elements. The Aggregate Pier ground improvement submittal must be prepared and sealed by a Professional Engineer licensed in the State of Maine and endorsed by the Aggregate Pier Installer.

Aggregate Pier installation method must consider minimizing vibrations which can adversely impact Kirk Hall and adjacent infrastructure. Consideration should be given to pre-drilling to help reduce vibrations, particularly for Aggregate Piers immediately adjacent to Kirk Hall.

4.5 Foundation Drainage

If an underdrain system exists around Kirk Hall, we recommend an underdrain system be installed on the outside edge of new perimeter footings and tied into the existing system. We tentatively recommend a 4-inch diameter, perforated SDR-35 foundation drain pipe bedded in Crushed Stone and wrapped in non-woven geotextile fabric. Alternatively, a 4-inch diameter slotted HDPE underdrain pipe enveloped in Underdrain Sand may be installed if that type of foundation drain already exists. The underdrain pipe must have a positive gravity outlet protected from freezing, clogging and backflow. Surface grades should be sloped away from the building for positive surface water drainage. General underdrain details are illustrated on the "Foundation Detail Sketch" attached in Appendix B.

4.6 Slab-On-Grade

On-grade floor slabs in heated areas may be designed using a subgrade reaction modulus of 100 pci (pounds per cubic inch) provided the slab is underlain by at least 12-inches of compacted Structural Fill placed over ground improved with Aggregate Piers. The structural engineer or concrete consultant must design steel reinforcing and joint spacing appropriate to slab thickness and function, as well as cracking and curling.

We recommend a sub-slab vapor retarder particularly in areas of the building where the concrete slab will be covered with an impermeable surface treatment or floor covering that may be sensitive to moisture vapors. The vapor retarder must have a permeance that is less than the floor cover or surface treatment that is applied to the slab. The vapor retarder must have sufficient durability to withstand direct contact with the sub-slab base material and construction activity. The vapor retarder material should be placed according to the manufacturer's recommended method, including the taping and lapping of all joints and wall connections. The architect and/or flooring consultant should select the vapor retarder products compatible with flooring and adhesive materials.

The floor slab should be appropriately cured using moisture retention methods after casting. Typical floor slab curing methods should be used for at least 7 days. The architect or flooring consultant should assign curing methods consistent with current applicable American Concrete Institute (ACI) procedures with consideration of curing method compatibility to proposed surface treatments, flooring and adhesive materials.

4.7 Entrance Slabs and Sidewalks

Entrance slabs and sidewalks adjacent to the building must be designed to reduce the effects of differential frost action between adjacent pavement, doorways, and entrances. We recommend that non-frost susceptible Structural Fill be provided to a depth of at least 4.5 feet below the top of entrance slabs. This thickness of Structural Fill should extend the full footprint of the entrance slab, thereafter transitioning up to the bottom of the adjacent sidewalk or pavement gravels at a 3H:1V or flatter slope. General details of this frost transition zone are shown on the "Foundation Detail Sketch" attached in Appendix B.

4.8 Fill, Backfill and Compaction

We recommend the following fill and backfill materials: recycled products must also be tested in accordance with applicable environmental regulations and approved by a qualified environmental consultant.

Common Borrow: Fill to raise grades landscape areas should be non-organic compactable earth meeting the requirements of 2020 MaineDOT Standard Specification 703.18 Common Borrow.

Granular Borrow: Fill to raise grades in building areas, as well as to backfill overexcavations, should be sand meeting the requirements of 2020 MaineDOT Standard Specification 703.19 Granular Borrow.

Structural Fill: Backfill for foundations, slab base material. and material below exterior entrances slabs should be clean, non-frost susceptible sand and gravel meeting the gradation requirements for Structural Fill as given below:

Structural Fill	
Sieve Size	**Percent Finer by Weight**
4 inch	100
3 inch	90 to 100
¼ inch	25 to 90
No. 40	0 to 30
No. 200	0 to 6

Crushed Stone: Crushed Stone, used beneath foundations and for underdrain aggregate, should be washed ¾-inch crushed stone meeting the requirements of 2020 MaineDOT Standard Specification 703.13 Crushed Stone ¾-Inch.

Underdrain Sand: Sand used for underdrains, as applicable, should be clean, free-draining sand meeting the requirements of 2020 MaineDOT Standard Specification 703.22 Underdrain Backfill Material Type B.

Reuse of Site Soils: The non-organic on-site soils are unsuitable for reuse in building areas, but may be suitable for reuse as Common Borrow in landscape areas, provided they are at a compactable moisture content at the time of reuse.

Placement and Compaction: Fill should be placed in horizontal lifts and compacted such that the desired density is achieved throughout the lift thickness with 3 to 5 passes of the compaction equipment. Loose lift thicknesses for grading, fill and backfill activities should not exceed 12 inches. We recommend that fill and backfill in building areas be compacted to at least 95 percent of its maximum dry density as determined by ASTM D-1557. Crushed Stone should be compacted with 3 to 5 passes of a vibratory plate compactor having a static weight of at least 500 pounds.

4.9 Weather Considerations

Construction activity should be limited during wet and freezing weather and the site soils may require drying or thawing before construction activities may continue. The contractor should anticipate the need for water to temper fills in order to facilitate compaction during dry weather. If construction takes place during cold weather, subgrades, foundations and floor slabs must be protected during freezing conditions. Concrete and fill must not be placed on frozen soil; and once placed, the concrete and soil beneath the structure must be protected from freezing.

4.10 Design Review and Construction Testing

S.W.COLE should be retained to review the construction documents prior to bidding to determine that our earthwork and foundation recommendations have been properly interpreted and implemented.

S.W.COLE should be retained to review the contractor delegated design submittal for Aggregate Pier ground improvement prior to construction.

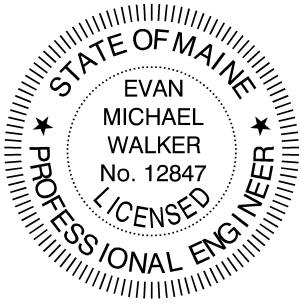
A construction materials testing and quality assurance program should be implemented during construction to observe compliance with the design concepts, plans, and specifications. S.W.COLE is available to observe earthwork activities, the preparation of foundation bearing surfaces, and ground improvement installation, as well as to provide testing and IBC Special Inspection services for soils, concrete, steel, spray-applied fireproofing, fire-stopping, structural masonry, and asphalt construction materials.

5.0 CLOSURE

It has been a pleasure to be of assistance to you with this phase of your project. We look forward to working with you during the construction phase of the project.

Sincerely,

S. W. Cole Engineering, Inc.



Evan M. Walker, P.E.
Senior Geotechnical Engineer

EMW:tjb

APPENDIX A

Limitations

This report has been prepared for the exclusive use of Central Maine Community College for specific application to the proposed Kirk Hall Addition at 1250 Turner Street in Auburn, Maine. S. W. Cole Engineering, Inc. (S.W.COLE) has endeavored to conduct our services in accordance with generally accepted soil and foundation engineering practices. No warranty, expressed or implied, is made.

The soil profiles described in the report are intended to convey general trends in subsurface conditions. The boundaries between strata are approximate and are based upon interpretation of exploration data and samples.

The analyses performed during this investigation and recommendations presented in this report are based in part upon the data obtained from subsurface explorations made at the site. Variations in subsurface conditions may occur between explorations and may not become evident until construction. If variations in subsurface conditions become evident after submission of this report, it will be necessary to evaluate their nature and to review the recommendations of this report.

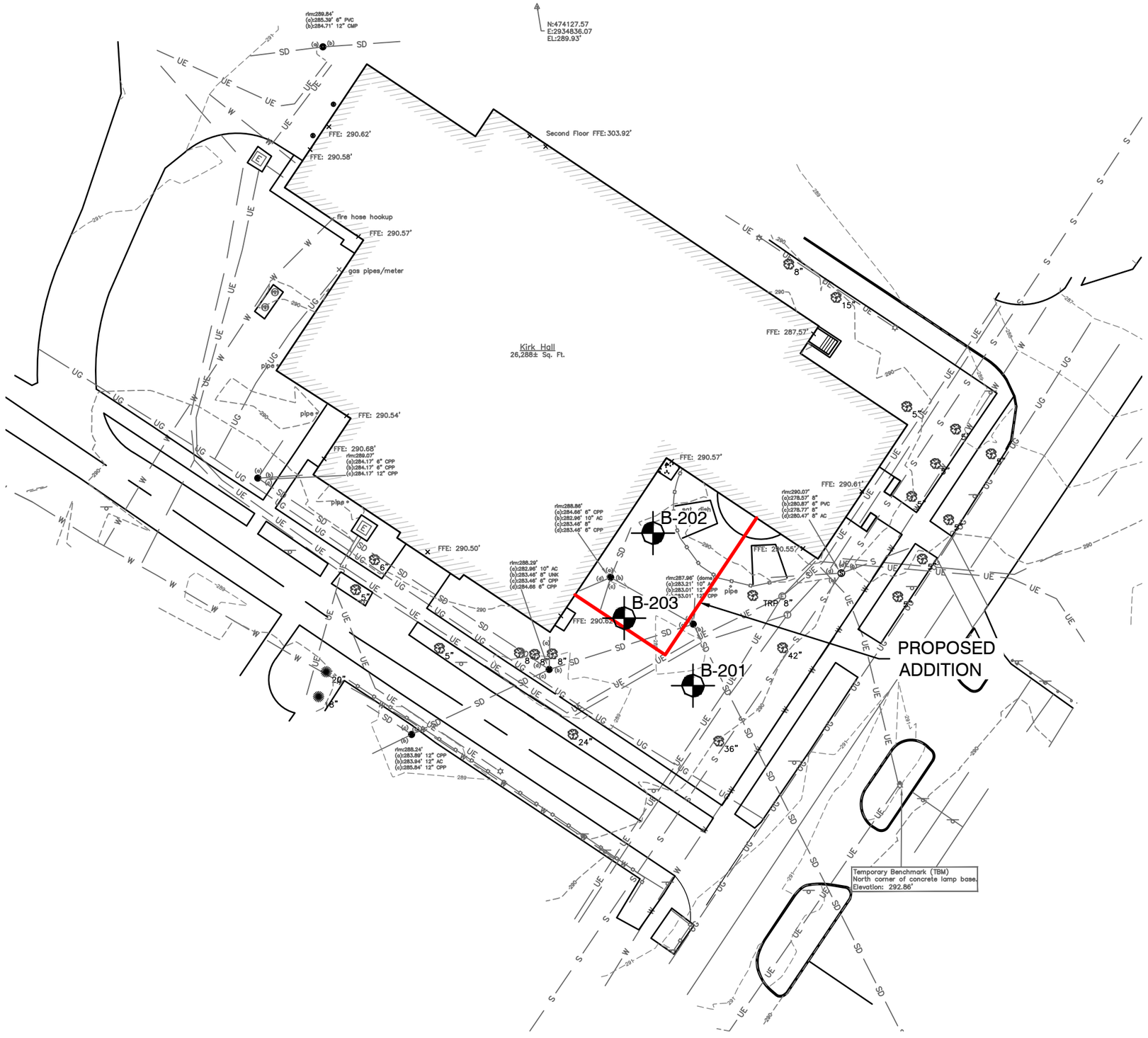
Observations have been made during exploration work to assess site groundwater levels. Fluctuations in water levels will occur due to variations in rainfall, temperature, and other factors.

S.W.COLE's scope of services has not included the investigation, detection, or prevention of any Biological Pollutants at the project site or in any existing or proposed structure at the site. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and the byproducts of any such biological organisms.

Recommendations contained in this report are based substantially upon information provided by others regarding the proposed project. In the event that any changes are made in the design, nature, or location of the proposed project, S.W.COLE should review such changes as they relate to analyses associated with this report. Recommendations contained in this report shall not be considered valid unless the changes are reviewed by S.W.COLE.

APPENDIX B

Figures



LEGEND:

APPROXIMATE BORING LOCATION

NOTES:

1. EXPLORATION LOCATION PLAN WAS PREPARED FROM A 1"=20' SCALE PLAN OF THE SITE ENTITLED "EXISTING CONDITIONS," PREPARED BY TITCOMB ASSOCIATES, DATED MARCH 15, 2018.
2. THE BORINGS WERE LOCATED IN THE FIELD BY MEASUREMENTS FROM EXISTING SITE FEATURES.
3. THIS PLAN SHOULD BE USED IN CONJUNCTION WITH THE ASSOCIATED S. W. COLE ENGINEERING, INC. GEOTECHNICAL REPORT.
4. THE PURPOSE OF THIS PLAN IS ONLY TO DEPICT THE LOCATION OF THE EXPLORATIONS IN RELATION TO THE EXISTING CONDITIONS AND PROPOSED CONSTRUCTION AND IS NOT TO BE USED FOR CONSTRUCTION.

0 40 80
Feet

S.W.COLE ENGINEERING, INC.

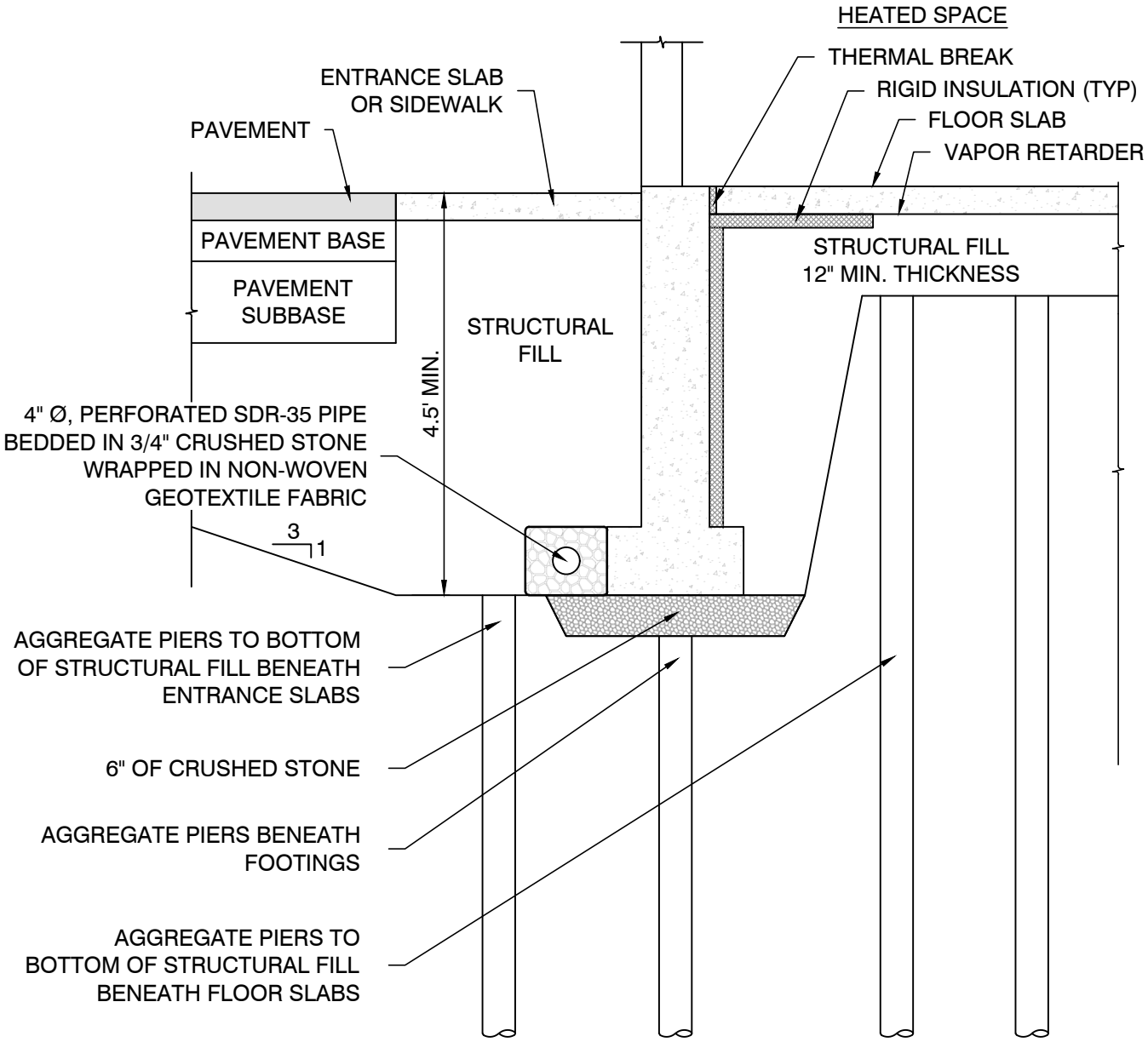
CENTRAL MAINE COMMUNITY COLLEGE

EXPLORATION LOCATION PLAN

PROPOSED ADDITION TO KIRK HALL
1250 TURNER STREET
AUBURN, MAINE

Job No.:	25-2165	Scale:	1" = 40'
Date :	01/26/2026	Sheet:	1

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NOTE:

1. UNDERDRAIN INSTALLATION AND MATERIAL GRADATION RECOMMENDATIONS ARE CONTAINED WITHIN THIS REPORT.
2. DETAIL IS PROVIDED FOR ILLUSTRATIVE PURPOSES ONLY, NOT FOR CONSTRUCTION.

S.W.COLE ENGINEERING, INC.

CENTRAL MAINE COMMUNITY COLLEGE

FOUNDATION DETAIL SKETCH

PROPOSED ADDITION TO KIRK HALL
1250 TURNER STREET
AUBURN, MAINE

Job No.:	25-2165	Scale:	Not to Scale
Date :	04/02/2026	Sheet:	2

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APPENDIX C

Exploration Logs and Key

BORING LOG

BORING NO.: B-201
SHEET: 1 of 1
PROJECT NO. 25-2165
DATE START: 1/16/2026
DATE FINISH: 1/16/2026

CLIENT: Central Maine Community College
PROJECT: Proposed Kirk Hall Addition
LOCATION: 1250 Turner Street, Auburn, Maine

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** 288' N/A **TOTAL DEPTH (FT):** 22.0 **LOGGED BY:** Nshuti Gato
DRILLING CO.: Seaboard Drilling **DRILLER:** Jeremy Adams **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A /N/A **CORE BARREL:**
HAMMER CORRECTION FACTOR: **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▽ 20 ft Soils Damp from Surface, Saturated Below 20' +/-
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level: ▽ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling
D = Split Spoon Sample; U = Thin Walled Tube Sample; R = Rock Core Sample; V = Field Vane Shear
Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.; q_u = Unconfined Compressive Strength, kips/sq.ft.; Ø = Friction Angle (Estimated); N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
			1D		0-2	24/13	2-5-5-6			0.3 Vegetation/Topsoil (FILL) Medium dense, brown, silty fine SAND, with silt seams and rootlets (FILL)		
			2D		2-4	24/18	6-8-8-8			2.0 Loose, brown, silty fine SAND, with dark brown silt seams (FILL)		
285												
	5		3D		5-7	24/10	3-3-3-3					
280												
	10		4D		10-12	24/14	4-3-3-2			9.0 Loose, dark brown, silty fine SAND, with rootlets (FILL)		
275										13.0 Medium dense, light brown, silty fine SAND		
	15		5D		15-17	24/24	5-6-7-6	w =9.4 %				
270												
	20		6D		20-22	24/20	4-3-3-3			20.0 Loose, light brown, fine to medium SAND, some silt	▽	

Bottom of Exploration at 22.0 feet

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING / WELL 10-12-2022 25-2165.GPJ SWCE TEMPLATE.GDT 4/3/26

BORING LOG

BORING NO.: B-202
SHEET: 1 of 1
PROJECT NO. 25-2165
DATE START: 1/16/2026
DATE FINISH: 1/16/2026

CLIENT: Central Maine Community College
PROJECT: Proposed Kirk Hall Addition
LOCATION: 1250 Turner Street, Auburn, Maine

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** 290' N/A **TOTAL DEPTH (FT):** 22.0 **LOGGED BY:** Nshuti Gato
DRILLING CO.: Seaboard Drilling **DRILLER:** Jeremy Adams **DRILLING METHOD:** Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50 **AUGER ID/OD:** 2 1/4 in / 5 5/8 in **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **CASING ID/OD:** N/A /N/A **CORE BARREL:**
HAMMER CORRECTION FACTOR: **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▽ 20 ft Soils Damp from Surface, Saturated Below 20'+/-
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level: ▽ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling
D = Split Spoon Sample; U = Thin Walled Tube Sample; R = Rock Core Sample; V = Field Vane Shear
Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.; q_u = Unconfined Compressive Strength, kips/sq.ft.; Ø = Friction Angle (Estimated); N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
			1D		0-2	24/16	2-1-3-3			0.3 Vegetation/Topsoil (FILL) Loose, brown, silty SAND, trace rootlets (FILL)		
			2D		2-4	24/18	5-4-6-6			2.0 Medium dense to loose, brown and dark brown, silty fine SAND, with silt seams (FILL)		
285	5		3D		5-7	24/24	3-2-2-2					
280	10		4D		10-12	24/16	4-4-4-3			10.5 Loose, brown to light brown, fine to medium SAND, some silt		
			5D		12-14	24/20	4-3-4-4					
275	15		6D		15-17	24/16	4-5-7-7			15.0 Medium dense, light brown, fine to medium SAND, some silt		
270	20		7D		20-22	24/16	5-3-4-4			20.0 Loose, brown, SAND, some silt	▽	

Bottom of Exploration at 22.0 feet

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING / WELL 10-12-2022 25-2165.GPJ SWCE TEMPLATE.GDT 4/3/26

BORING LOG

CLIENT: Central Maine Community College
PROJECT: Proposed Kirk Hall Addition
LOCATION: 1250 Turner Street, Auburn, Maine

BORING NO.: B-203
SHEET: 1 of 1
PROJECT NO. 25-2165
DATE START: 1/16/2026
DATE FINISH: 1/16/2026

Drilling Information

LOCATION: See Exploration Location Plan
ELEVATION (FT): 288.5' N/A
TOTAL DEPTH (FT): 22.0
LOGGED BY: Nshuti Gato
DRILLING CO.: Seaboard Drilling
DRILLER: Jeremy Adams
DRILLING METHOD: Hollow Stem Auger
RIG TYPE: Track Mounted Diedrich D-50
AUGER ID/OD: 2 1/4 in / 5 5/8 in
SAMPLER: Standard Split-Spoon
HAMMER TYPE: Automatic
HAMMER WEIGHT (lbs): 140
CASING ID/OD: N/A /N/A
CORE BARREL:
HAMMER CORRECTION FACTOR:
HAMMER DROP (inch): 30
WATER LEVEL DEPTHS (ft): ▽ 20 ft Soils Damp from Surface, Saturated Below 20'+/-
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level: ▽ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling
D = Split Spoon Sample; U = Thin Walled Tube Sample; R = Rock Core Sample; V = Field Vane Shear
Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.; q_u = Unconfined Compressive Strength, kips/sq.ft.; Ø = Friction Angle (Estimated); N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
			1D		0-2	24/11	1-2-7-7			0.3 Vegetation/Topsoil (FILL) Loose, brown, silty fine SAND, trace rootlets (FILL)		
			2D		2-4	24/18	9-8-10-8			2.0 Medium dense, dark gray-brown, silty fine SAND, with dark brown silt seams (FILL)		
285												
	5		3D		5-7	24/14	3-2-2-1			5.0 Loose, gray-brown, silty fine SAND (FILL)		
			4D		7-9	24/16	2-1-2-4			7.0 Loose, gray-brown and dark brown, silty fine SAND, trace gravel, with fibrous organics (FILL)		
280												
	10		5D		10-12	24/23	4-4-4-5			10.0 Loose, dark brown, silty SAND, with wood (FILL)		
										13.0 Loose, light brown, silty fine SAND		
275												
	15		6D		15-17	24/18	5-4-5-4					
270												
	20		7D		20-22	24/20	5-6-5-5			20.0 Medium dense, brown, fine to medium SAND, some silt	▽	

Bottom of Exploration at 22.0 feet

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

KEY TO NOTES & SYMBOLS

Test Boring and Test Pit Explorations

Stratification lines represent the approximate boundary between soil types and the transition may be gradual.

Key to Symbols Used:

w	-	water content, percent (dry weight basis)
q_u	-	unconfined compressive strength, kips/sq. ft. - laboratory test
S_v	-	field vane shear strength, kips/sq. ft.
L_v	-	lab vane shear strength, kips/sq. ft.
q_p	-	unconfined compressive strength, kips/sq. ft. – pocket penetrometer test
O	-	organic content, percent (dry weight basis)
W_L	-	liquid limit - Atterberg test
W_P	-	plastic limit - Atterberg test
WOH	-	advance by weight of hammer
WOM	-	advance by weight of man
WOR	-	advance by weight of rods
HYD	-	advance by force of hydraulic piston on drill
RQD	-	Rock Quality Designator - an index of the quality of a rock mass.
γ_T	-	total soil weight
γ_B	-	buoyant soil weight

Description of Proportions:

Trace:	0 to 5%
Some:	5 to 12%
"Y"	12 to 35%
And	35+%
With	Undifferentiated

Description of Stratified Soils

Parting:	0 to 1/16" thickness
Seam:	1/16" to 1/2" thickness
Layer:	½" to 12" thickness
Varved:	Alternating seams or layers
Occasional:	one or less per foot of thickness
Frequent:	more than one per foot of thickness

REFUSAL: **Test Boring Explorations** - Refusal depth indicates that depth at which, in the drill foreman's opinion, sufficient resistance to the advance of the casing, auger, probe rod or sampler was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

REFUSAL: **Test Pit Explorations** - Refusal depth indicates that depth at which sufficient resistance to the advance of the backhoe bucket was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

Although refusal may indicate the encountering of the bedrock surface, it may indicate the striking of large cobbles, boulders, very dense or cemented soil, or other buried natural or man-made objects or it may indicate the encountering of a harder zone after penetrating a considerable depth through a weathered or disintegrated zone of the bedrock.

APPENDIX D

Laboratory Test Results

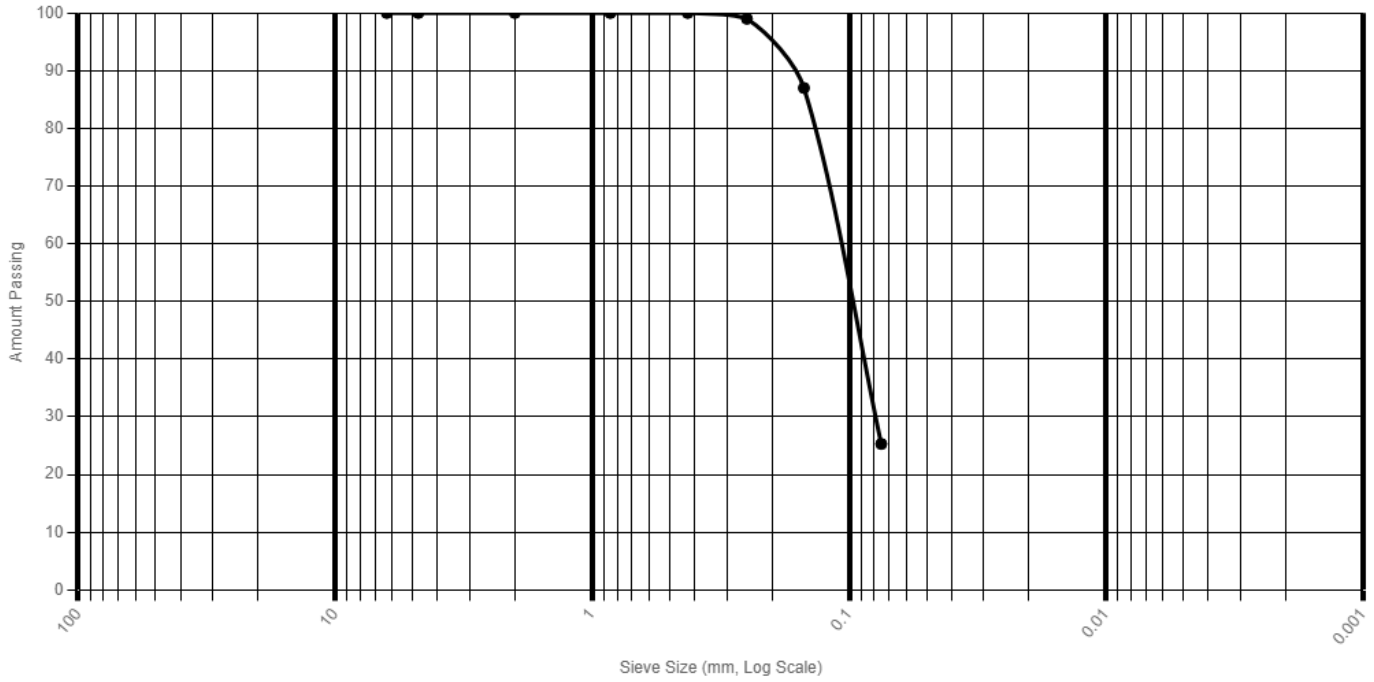
S.W.COLE ENGINEERING, INC.

Report of Gradation

ASTM C136 & C117

Project Name:	Auburn ME - Proposed Kirk Hall Addition - Geotechnical Engineering Services	**Project #:**	25-2165
		Lab ID:	34108G
		Date Received:	4/1/2026
Client:	Central Maine Community College	**Date Completed:**	4/8/2026
		Tested By:	Leah Younge
Sample Description:	Boring Sample	**Exploration:**	N/A
Material Source:	B- 201, 5D, 15-17'		

Standard Designation (mm/µm)	Sieve Size	Amount Passing (%)	
6.3 mm	1/4"	100%	
4.75 mm	No. 4	100%	0% Gravel
2 mm	No. 10	100%	
850 µm	No. 20	100%	
425 µm	No. 40	100%	74.7% Sand
250 µm	No. 60	99%	
150 µm	No. 100	87%	
75 µm	No. 200	25.3%	25.3% Fines



Remarks: w=9.4%

Sarah Sylvia

Reviewed By

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

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 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: 20 mils.
   4. Products:
      a. Stego Industries LLC; Stego Wrap Vapor Barrier.
      b. W.R. Meadows; Perminator.
      c. 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, erection and removal of formwork, bracing and shoring.
3. Furnishing and placing of reinforcing steel and related accessories.
4. Installation of vapor retarder (barrier).
5. Furnishing and installation of underslab and perimeter insulation.
6. Furnishing and installation of bentonite strip waterstops.
7. Furnishing and installation of joint fillers.
8. Furnishing and installation of joint sealants.
9. Installation of embedded items furnished by others.
10. Setting of anchor bolts and grouting of leveling plates and bearing plates.
11. As-built survey of leveling plates, bearing plates and anchor rods.
12. Grouting anchor rod oversized holes at column base plates.
13. Furnishing and installation of mastic coating on embedded structural steel.
14. 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.
15. Hardening and sealing of exposed concrete floors.
16. Coordination of floor slab finish requirements with flooring manufacturers and contractors.
17. As-built surveys of concrete floor slab elevations.
18. Leveling of concrete slabs with a self-leveling concrete underlayment if required to meet the specified tolerances.

B. Items to be furnished only: Furnish the following items for installation by the designated Sections:

1. Section 05 12 00 STRUCTURAL STEEL FRAMING: Weldable threaded rebar couplers, as indicated on the Drawings.

C. Items to be installed only: Install the following items furnished by the designated Sections:

1. Section 05 12 00 STRUCTURAL STEEL FRAMING: Anchor bolts, leveling plates, and structural steel shapes and plates embedded in concrete with anchors or headed studs, as indicated on the Drawings.
2. Section 05 50 00 METAL FABRICATIONS: Steel nosings in concrete stairs, as indicated on the Drawings.
3. Section 07 95 13 EXPANSION JOINT COVER ASSEMBLIES: Expansion joint covers, as indicated on the Drawings.

1.03 RELATED SECTIONS

A. Related work shall be performed under the following Sections:

1. Section 03 05 16 UNDERSLAB VAPOR BARRIER
2. Section 03 35 13 CONCRETE FLOOR FINISHES
3. Section 04 20 00 UNIT MASONRY
4. Section 05 12 00 STRUCTURAL STEEL FRAMING
5. Section 05 12 26 SHEAR CONNECTORS
6. Section 05 31 00 STEEL DECKING
7. Section 05 50 00 METAL FABRICATIONS
8. Section 07 11 13 BITUMINOUS DAMPROOFING
9. Section 07 14 00 FLUID-APPLIED WATERPROOFING.
10. Section 07 26 16 BELOW-GRADE VAPOR RETARDER.
11. Section 07 16 16 CRYSTALLINE WATERPROOFING.
12. Section 07 21 00 THERMAL INSULATION.
13. Section 07 90 00 JOINT PROTECTION.
14. Section 09 90 00 PAINTINGS AND COATINGS.
15. Section 22 13 17 RADON MITIGATION SYSTEM.
16. Section 31 00 00 EARTHWORK.
17. Section 31 50 00 EXCAVATION SUPPORT AND 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. Submittals requiring approval prior to Shop Drawing preparation:

1. Prior to the preparation of concrete reinforcement Shop Drawings, submit proposed construction joint locations for all walls, slabs on grade, slabs on metal deck, beams, and other concrete elements.
2. Prior to the preparation of concrete reinforcement Shop Drawings, submit drawings showing proposed control joint layout locations for all slabs on grade. For slabs on grade reinforced with bars, reinforcing shall be detailed such that every other bar is interrupted at control joint locations.

D. 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. Formwork Shop Drawings: Schedules of placement; beam and haunch detailing, expansion joint details, construction joints with methods of forming; general arrangement, sizes and grades of lumber, panel and tie layouts and alignment. At Architecturally Exposed Concrete areas, show layout of joint patterns and exposed cone recesses at wall ties. Formwork drawings shall be reviewed for general compliance with the Contract Documents only. Dimensions, strength of formwork, shoring, bracing, and all related work are the sole responsibility of the Contractor.
3. 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.

E. 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; form ties and spreaders; accessories for reinforcement; reglets; non-shrink cement grout; inserts; form release agents; waterstops; 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. Submittal shall include methods of cold and hot weather concreting and protection following the requirements of ACI 306 – Guide to Cold Weather Concreting and ACI 305 – Guide to Hot Weather Concreting, respectively, and as specified herein.
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.

F. 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.

G. 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.

H. 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, cold- and hot- weather concreting procedures, curing and protection procedures, construction, control and isolation joints, joint filler strips, semi-rigid joint fillers, forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, concrete finishing, slab flatness and levelness measurements, slab elevation survey, and concrete repair procedures.
3. Before concrete slabs on grade and slabs on deck are placed, and after approval of all resilient flooring materials, a pre-flooring conference shall be held. In attendance shall be (1) Architect, (2) General Contractor, (3) Concrete Subcontractor, (4) Flooring Subcontractor, and (5) Flooring manufacturer's technical representative. The parties shall review Drawings, Specifications and approved materials and coordinate surface finishing requirements, methods of curing and protection, and moisture and PH limits of the concrete required for the application of the finish flooring materials.

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:

Sieve	Retained Percent
#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. Fiber reinforcement for concrete shall be 100% virgin polypropylene fibrillated fibers, conforming to ASTM C1116 Type III, as manufactured by Fibermesh, Euclid Chemical Company, W.R. Grace & Co., equal approved by Architect. Fibers shall be added at the batching plant, in accordance with the manufacturer's recommendation, but not less than 1.5 pounds per cubic yard of concrete.
5. 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.
6. 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. Formwork:

1. Forms for concrete surfaces not exposed to view, shall be made of wood, metal, or other material subject to approval of Architect.
2. Forms for Architecturally Exposed Concrete surfaces shall be new, Class 1 B-B High Density Overlay plyform, exterior grade not less than 5 ply nor less than 5/8 inch thick, conforming to United States Department of Commerce (DOC) Voluntary Product Standard PS 1. Forms shall be subject to approval by the Architect by way of sample panels.
3. Forms for exposed to view surfaces not labeled as Architecturally Exposed Concrete and surfaces to receive a skim coat of plaster and/or paint shall be made of new, smooth material and shall be subject to approval by the Architect by way of sample panels.
4. Form release agent shall be of a non-staining type, specifically manufactured for concrete forms.
5. Form ties shall be factory-fabricated, removable or snap back of approved design. Wire shall be at least 1-1/2 inch back from exterior surfaces and one inch from interior surfaces. Furnish with removable wooden or plastic cones of approved sizes where called for, with waterproof stop at surfaces of Architecturally Exposed Concrete.
6. Chamfer strips shall be one-half inch, 45 degree wood strips, or as detailed, nailed six inches on center, and installed at inside corners of all forms, unless otherwise directed by the Architect.
7. Reglets shall be formed from 24 gauge galvanized steel and shall be of type shown on Drawings or appropriate for use intended. Metal reglets shall be used merely as forms to obtain desired profile. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris. After concrete has set, remove reglets.

G. 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.

H. 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.

I. 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.

J. 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. Underslab Vapor Retarder: See Section 03 05 16.

4. Underslab and Perimeter Insulation: See Section 07 21 00.

5. Underslab built-up voids shall be rigid cellular polystyrene geofoam blocks with a minimum compressive strength of 40 PSI (value at yield or 10% compression). Molded bead polystyrene is not permitted. Manufacturers shall be Universal Foam

Products, ACH Foam Technologies, Atlas EPS, or approved equal.

6. Threaded Inserts and Wedge Inserts: Hohmann & Barnard, Richmond Screw Anchor Co., Heckmann Building Products, or equal structural concrete inserts of type shown on Drawings. Galvanize all components in accordance with ASTM A153.
7. 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.
8. Waterstops shall be bentonite strip type “Waterstop – RX”, manufactured by Cetco, “Swellstop” by Greenstreak Inc., “Rockmax Swelling 101” by Rockmax Co. Ltd. or equal as approved by the Architect.
9. Non-Shrink Grout: Grout at column and beam bearing shall be “MasterFlow 100” by Sika Group, “588-10K” by W. R. Meadows, "Five Star Grout" by Five Star Products, Inc. or equal approved by the Architect.
10. Anchor Rod Base Plate Hole Grout: Grout in oversize anchor rod holes at brace column steel base plates shall be “MasterFlow 816” by Master Builders, “Five Star Fluid Grout PT” by Five Star Products, Inc., “Quikrete Cable Duct Grout” by Quikrete, or equal approved by the Architect.
11. Dovetail Anchor Slots shall be formed of not less than 20 gauge hot dipped galvanized steel, one inch by one inch and furnished with felt or fiber fillers.
12. Mastic coating of structural steel below the top of slab on grade elevation shall be a high-build coal tar epoxy mastic as manufactured by Carboline, Inc., Sumter Coatings, Inc., Rust-Oleum, Inc., Krylon Industrial Coatings, Inc. 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. Electrical Ductbanks: f’c = 2,500 psi
2. Footings and grade beams: f’c = 4,000 psi
3. Foundation walls, site walls, piers and pilasters: f’c = 4,000 psi
4. Slabs on grade and slabs on deck: f’c = 4,000 psi
5. Stair treads and landings: f’c = 4,000 psi
6. Structural concrete beams: f’c = 5,000 psi
7. Exterior concrete slabs and site walls subject to de-icing salts: f’c = 5,000 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 = 2,500 psi GWP = 183.29 kg CO_2e/yd^3
2. f’c = 4,000 psi GWP = 240.22 kg CO_2e/yd^3
3. f’c = 5,000 psi GWP = 289.03 kg CO_2e/yd^3

C. The maximum water/cement ratios for the ACI Concrete Exposure Classes are listed

below:

1. Exposure Class F1 (Footings and Foundation Walls): Max. w/cm Ratio = 0.55
2. Exposure Class F2 (Exterior, Exposed Walls): Max. w/cm Ratio = 0.45
3. Exposure Class F3 (Site Paving): Max. w/cm Ratio = 0.40

D. 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

E. 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).

F. All concrete with a strength of 4,000 psi or higher shall have a minimum coarse aggregate content of 1,600 lbs/cu.yd.

G. Air-entraining and water-reducing admixtures shall be used in strict accordance with the manufacturer's printed instructions. All exterior concrete subjected to freezing and thawing (ACI Concrete Exposure Classes F2 and F3) shall have a total air content of 6% plus or minus 1.5%. All interior concrete slabs shall have a maximum air content of 3% (non-air entrained) and all other interior concrete shall have a total air content of 4% plus or minus 1%. All concrete shall contain a water-reducing admixture. Use a high range water-reducing admixture (superplasticizer) in concrete for slabs on grade and slabs on steel deck.

H. 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.

I. 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.

J. Exterior concrete slabs on grade shall contain a calcium nitrate corrosion inhibiting admixture with a dosage rate of two gallons per cubic yard.

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. All forms shall be stored in neat manner and orderly fashion, protected from the weather and abuse.

E. 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 FORMING

A. Formwork construction shall be as specified in ACI 347 "Guide to Formwork for Concrete".

1. Provide Class A tolerances for all visually exposed concrete surfaces.
2. Provide Class C tolerances for other concrete surfaces.

B. Acceptable tolerances shall be as specified in ACI 117 “Standard Specifications for Tolerances for Concrete Construction and Materials”.

C. Forms shall be constructed to conform to shapes, lines, and dimensions shown, plumb and straight, and shall be maintained sufficiently rigid to prevent deformation under load. Forms shall be sufficiently tight to prevent the leakage of grout. Securely brace and shore forms to prevent displacement and to safely support the construction loads.

D. Treat forms with a form release agent applied according to the manufacturer's instructions, by roller, brush or spray to produce a uniform thin film without bubbles or streaks. Apply the release agent in two coats for the first use of the form and in one coat for each additional use.

3.03 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 03 05 16.

3.04 RIGID INSULATION

A. Place rigid insulation boards beneath slabs-on-grade, against vertical faces of foundation walls and at other locations, 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.

3.05 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. Take particular care to bend tie wire ends away from exposed faces of beams, slabs, walls, and columns. 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. Provide welded wire fabric in all concrete stair treads and landing slabs.

E. Do not “wet-stick” reinforcing or anchor rods into wet concrete.

F. Reinforcing shall be free of excessive rust, scale or other coatings that will reduce bond.

G. 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".

3.06 JOINTS

A. Provide construction joints as shown on the Drawings, but in any case limit the maximum dimensions for placement of concrete in any one placement as follows:

1. Walls: 80 feet
2. Grade beams: 100 feet
3. Slabs-on-grade: 100 feet
4. Slabs-on-metal deck: 125 feet

B. Allow a minimum of three days' time between concrete pours at construction joints.

C. Construction joints shall be formed with keyed bulkheads. At joint locations labeled on the drawings as roughened joints, the entire contact surface shall be mechanically roughened with a roughness of at least ¼" amplitude and an approved bonding agent shall be used in accordance with the manufacturer's recommendations. All construction joints shall be free of debris. Reinforcement shall continue through the joint, and additional reinforcement shall be placed as indicated on the Drawings.

D. Provide control joints as shown on the Drawings (refer also to Architectural drawings for exposed areas with added joints), but in any case, joints shall be located as follows:

1. Slabs on grade (non-exposed areas): On column lines in each direction and at 15 feet on center between column lines, maximum.
2. Slabs-on-grade (exposed areas): On column lines in each direction and at 10 feet on center between column lines, maximum.

E. Cut every other wire of welded wire fabric at control joints. Where slabs on grade are reinforced with bars, lay out bars such that every other bar is interrupted at control joints. Control joints in slabs on grade shall be sawcut as early as practical after placement and finishing of concrete but no later than the following day.

F. Do note provide control joints in slabs on metal deck, structural slabs or slabs on grade to receive wood flooring.

G. Provide isolation joints between slabs on grade and steel columns/gusset plates, and where shown on the Drawings. Isolation joint fillers shall be installed with removable top snap-caps so that the joint filler material to remain is ½ inch below the top surface of the slab to allow for joint sealants.

3.07 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 anchor rods, sleeves, inserts, weld plates, angles 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 toppings on steel deck or in slabs on grade. Electrical conduit embedded in structural concrete beams, slabs and columns must meet the following conditions:
    a. No conduit coating, except galvanizing or equivalent shall be used.
    b. Do not embed aluminum conduit in concrete.
    c. Do not cut or displace any reinforcement without prior approval by Architect.
    d. Place conduit within the middle half of any member. Do not place conduit between concrete surfaces and reinforcement.
    e. Restrict outside diameter of conduit placed within formed, suspended, structural slabs to less than 1/4 of slab thickness. Place within middle of slab thickness, between primary reinforcing.
    f. Conduit with outside diameter greater than 1/6 of formed slab thickness shall be placed parallel or at right angles to slab reinforcing, not diagonally.
    g. Space nearly parallel conduits at least three times outside diameter apart.
    h. Do not embed conduit over 4 percent of the gross concrete area lengthwise in beams or columns.
    i. Do not tie conduit to reinforcing bars.

3.08 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. In hot weather, all concreting shall be done in accordance with ACI 305, "Guide to Hot Weather Concreting" and as specified below:
    1. The temperature of concrete delivered to the forms shall not exceed 90 degrees.
    2. Chilled mixing water or chopped ice may be used to control concrete temperature, provided water equivalent of ice is calculated to total amount of mixing water.
    3. The temperature of the forms shall not be over 90 degrees F.

D. In cold weather, all concreting shall be done in accordance with ACI 306, “Guide to Cold Weather Concreting” and as specified below:
    1. When the average daily temperature falls below 40 degrees F, all surfaces of concrete shall be maintained at a temperature of at least 50 degrees F and not over 90 degrees F for seven (7) days.
    2. Concrete delivered to the forms shall have a temperature of at least 60 degrees F and not over 90 degrees F.
    3. The temperature of the forms including gravel base, shall be at least 40 degrees F.
    4. The Contractor shall maintain a record of temperature of the concrete at the most exposed surfaces of each placement at the beginning and at the end of each day of the curing period, which shall be available to the Architect.
    5. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
    6. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

E. 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.

F. 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.

G. Concrete shall be deposited continuously, in horizontal layers of such thickness (not deeper than 18 inches) 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.

H. 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.

I. 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.

3.09 LEVELING AND BEARING PLATE INSTALLATION

A. Grout solid all column leveling plates and beam bearing plates in accordance with manufacturer's recommendations.

B. Install column leveling plates and beam bearing plates to required elevations and comply with tolerances specified in Chapter 7 of AISC 303 “Code of Standard Practice for Steel Buildings and Bridges”.

3.10 FINISHING OF VERTICAL CONCRETE SURFACES

A. The intent of this Specification is to secure for the job, materials and workmanship of such quality that only nominal finishing will be required to produce concrete surfaces equal to the best obtainable with the concrete and forming materials specified. Surfaces which reveal, upon removal of forms, imperfections of such magnitude as to seriously impair the appearance of the structure, in the opinion of the Architect, shall be deemed cause for rejection, and concrete members containing such imperfections shall be entirely removed and replaced without damage to adjacent materials or extra expense to the Owner. Lesser imperfections of concrete surfaces shall be patched and finished in accordance with the following procedures.

B. Patching - Areas to be patched shall not exceed 1.5 square feet for each 1000 square feet of surface area. Patches shall match in every respect, the color and texture of the surrounding surfaces. Mix formulation shall be determined by trial to obtain a color match when both the patch and the surrounding concrete are cured and dry. After initial set, surfaces of patches shall be textured manually to obtain a match with the surrounding surfaces. All patches are subject to Architect's final acceptance as to appearance and quality.

C. Corrective Work: Submit drawings showing details of any proposed corrective work.

D. Surfaces to Receive Sandblast Finish: Upon completion of patching operations, sandblast all exterior vertical surfaces and all other surfaces indicated as receiving sandblast finish.

1. Use a #400 gradation abrasive that will not adversely affect the color of the finished surface, such as “Black Beauty” supplied by Harsco Minerals, “Garnet Sand” supplied by Dawson-MacDonald, or approved equal.
2. Abrasive blasting shall be carried out to the same depth and produce the same

texture as the accepted sample panel throughout. Sandblasting shall be done after all concrete to be blasted has attained a strength of 3,000 psi as determined by field control cylinders, or after a minimum of seven days, whichever is first.

3. The Contractor shall be responsible for safety of the workmen and for any damage or claims resulting from this operation and shall equip each person with an air-fed helmet. Provide suitable enclosures for collecting grit and dust from the blasting operation. Sandblasting shall comply with all local and state anti-pollution laws.
4. During abrasive blasting, surfaces intended to be left smooth, such as rustications, chamfers and tie cone holes, shall be protected from blasting by masking with wood, metal, rubber or tape. Avoid rounding edges. All inserts shall be masked and protected from blasting.

E. Finishing Concrete Vertical Surfaces Exposed to View and not scheduled to be sandblasted: Provide a smooth-formed surface obtained with selected form-facing material arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

1. Smooth-Rubbed Finish: Provide smooth-rubbed finish on exposed concrete vertical surfaces that have received smooth-formed finish treatment not later than one day after form removal.
2. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process. Thoroughly clean surfaces to remove stains, laitance, dust, form oil, and all other surface residue by use of water, stiff brushes, sandpaper or other means approved by the Architect.

F. Finishing of Concealed Concrete Surfaces - At surfaces to receive waterproofing membranes, chip off fins and other projections and trowel patch all voids, honeycombs and air pockets exceeding 1/2" in any dimension. Pull tie-rods and patch voids formed by tie-rod cones flush with adjacent surfaces. At outside faces of foundation walls, except for surfaces to receive waterproofing membranes, trowel patch all voids, honeycombs and air pockets exceeding 3/4" in depth. At other concealed surfaces, patching, if any, shall be as directed by the Architect and shall, in general, be only such as is required to assure or protect the structural integrity of concrete or reinforcing.

3.11 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 for floor slabs on metal deck shall be poured to the specified elevation(s) by adding concrete to compensate for deck and structural member deflections. Composite steel beams and steel deck are designed to be unshored and have been designed for the weight of additional concrete. Slab thickness indicated on the Drawings is a minimum. Assume approximately one and one quarter inch additional thickness concrete at mid-bay required (or ¾ ± inch average additional concrete slab thickness over the entire structural bay). Slabs on metal deck shall not be placed until the building frame has been plumbed and the installation of the permanent lateral force resisting system has been completed. Deposit concrete uniformly on the deck; do not exceed the design construction live load. Motorized/wheeled equipment (laser screeds, hose buggies, etc.) shall not be used on the steel deck during placement operations.

C. 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: Only F_F numbers are applicable to elevated reinforced concrete slabs and slabs on metal deck. Both F_F and F_L numbers are applicable to slabs on grade.

D. 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.

E. Slab Elevation Tolerance: The top surface elevation of formed floor slabs, slabs on steel deck and 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. The top surface of the stage floor slab on grade must not vary from the specified design elevation by more than +/-1/8" (¼" envelope).

F. Concrete slab surfaces shall be sloped uniformly to drains where noted on the Drawings.

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

3.12 SURVEY

A. Engage the services of a licensed Engineer or Surveyor to survey elevations and plan locations of all leveling plates, bearing plates and anchor rods. Any deviation from the specified tolerances shall be brought to the attention of the Architect.

B. The Contractor shall engage the services of a licensed Engineer or Surveyor to provide as-built surveys of concrete slab on grade and concrete slab on deck elevations at all levels. Surveys at each level shall include, but not be limited to, elevation readings at the following locations:

1. At each perimeter and interior column.
2. Mid-way between each perimeter and interior column on the column centerlines.
3. At mid-bay.

C. Surveys shall be taken no later than 72 hours after concrete placement and prior to removal of shoring, as applicable.

D. Submit a summary of results for review by the Architect. Additional readings may be requested, at the direction of the Architect. Floor leveling, if required, shall be as specified in this Specification.

3.13 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. Provide temporary formwork at building perimeter and at edges of openings as indicated on the Drawings.
5. Protect newly applied underlayment from premature surface drying and moisture loss.

3.14 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. Vertical or near vertical surfaces may be cured by maintaining wood forms continuously wet during curing period, by wrapping with continuous .006" polyethylene with taped joints, or by an alternate method approved by the Architect.

C. Refer to Hot- and Cold-Weather concreting procedures in this Section for additional requirements.

D. 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.

E. 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.

3.15 FORM REMOVAL

A. Forms shall be removed without damage to concrete. The Contractor shall be responsible for the safety of the construction during and after form removal. No act of the Architect shall relieve him of this responsibility.

B. Protect corners from damage after form removal by boxing, corner boards or other means approved by the Architect.

C. Formwork for pilasters, walls, and other parts not supporting the weight of concrete may be removed as soon as the concrete has reached 30% of its specified 28-day strength, but not before 2 days, provided it is properly cured and protected.

D. Exposed Concrete Surfaces - Immediately after removal of forms, chip off all fins, and other projections, and patch all voids, honeycombs, and air pockets exceeding ¾ inch in any dimension. In areas where concentrations of small voids occur, patch a sufficient number of voids to produce a uniform appearance across the entire panel. Smooth out projections and fins with wet carborundum stones or power grinders to extent directed by Architect. Pull tie rods and pack voids formed by tie-rod cones to a point ¾ inch from finish surface. Patch exposed irregular lines at edges of slab soffits to produce neat, uniform appearance.

E. Foundation walls to retain earth shall not be backfilled until the adjacent slabs at the top and bottom of the wall have achieved their full 28 day strength. Alternatively, the Contractor may provide an engineered temporary wall bracing system to withstand lateral earth pressures during construction. Temporary bracing shall remain in place until slabs have reached their full strength.

3.16 WATERSTOP

A. Install continuous Bentonite strip waterstop at vertical and horizontal construction joints in elevator pits, basement walls and as shown on the Drawings. Installation shall be in accordance with manufacturer's recommendations.

3.17 MASTIC COATING OF EMBEDDED STRUCTURAL STEEL

A. Install mastic coating continuously over steel embedded in concrete or soil in accordance with the manufacturer’s recommendations.

3.18 CUTTING OF HOLES

A. Holes required by other trades in any cast-in-place concrete which did not receive

sleeves shall be cut by the respective trades. Use a core drilling process or sawing process which produces clean sharp edges and the minimum hole size which accommodates the piping, conduit, or equipment requiring the opening. Field locate all reinforcing bars prior to coring and do not cut bars.

B. Obtain approval of Architect before cutting any holes for any trades.

3.19 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.

3.20 GROUTING OF ANCHOR ROD BASE PLATE HOLES

A. Grout solid all oversize brace column steel base plate holes around anchor rods in accordance with manufacturer's recommendations.

END OF SECTION 03 30 00

SECTION 03 35 11
CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Liquid densifiers and hardeners.

B. Clear penetrating sealers.

C. Concrete stain for existing precast concrete.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

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

1.03 REGULATORY REQUIREMENTS

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

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with concrete floor placement and concrete floor curing.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and 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. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

1.06 QUALITY ASSURANCE

A. Floor Finisher: Floor finishing contractor shall have at least five years of experience with the products specified in this Section and shall be trained and licensed by the manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's sealed packaging, including application instructions.

1.08 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Do not use frozen material; thaw and agitate prior to use.

C. No satisfactory procedures are available to remove petroleum or rust stains from concrete. Prevention is therefore essential. Take precautions to prevent staining of concrete prior to application of cure-seal-hardener and for minimum of three months after application:

1. Prohibit parking of vehicles on concrete slab.
2. If vehicles must be temporarily parked on slab, place drop cloths under vehicles during entire time parked.
3. If construction equipment must be used for application, diaper all components that might drip oil, hydraulic fluid, or other liquids.
4. Prohibit pipe cutting using pipe cutting machinery on concrete slab.
5. Prohibit temporary placement and storage of steel members on concrete slab.

1.09 WARRANTY

A. Provide manufacturer's warranty that a structurally sound concrete surface prepared and treated according to the manufacturer's directions will remain permanently dustproof, hardened

and water repellent. If after the specified sealing period the treated surface does not remain dustproof, hardened and water repellent, provide, at manufacturer's expense, sufficient material to reseal defective areas.

PART 2 PRODUCTS

2.01 CONCRETE STAIN

A. Concrete Stain, Type CS-1; Translucent, water based stain.
   1. Color: As selected by Architect.
   2. Products:
      a. PROSOCO, Inc; Gemtone Stain.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 CONCRETE FLOOR FINISH

A. Concrete Sealer, Type SC; including liquid densifier/hardener applied to concrete of any age followed by application of penetrating sealer.
   1. Liquid Densifier and Hardener: Penetrating chemical compound that reacts with concrete, filling the pores, hardening, and dustproofing.
      a. Composition: Lithium silicate.
      b. Products:
         1) PROSOCO, Inc; Consolideck LS/CS.
         2) Substitutions: See Section 01 60 00 - Product Requirements.
   2. Penetrating Sealer: Transparent, nonyellowing, water- or solvent-based coating.
      a. Composition: Siloxane.
      b. Products:
         1) PROSOCO, Inc; Consolideck Concrete Protector SB.
         2) Substitutions: See Section 01 60 00 - Product Requirements.

2.03 ACCESSORIES

A. Water: Clean, potable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that floor surfaces are acceptable to receive the work of this section.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Slabs shall be clean and dry. Test slabs with a light water spray to determine uniform absorption characteristics. Do not proceed with installation until slab surfaces are acceptable to the manufacturer.

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.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Prevent damage to and soiling of adjacent work.

C. CS-1 Application:
   1. Test stain on existing sill in a concealed location prior to application in exposed locations.
   2. Apply stain in accordance with manufacturer's instructions.
   3. Apply penetrating sealer as specified in this Section.

D. SC Application:

1. Apply materials in accordance with manufacturer's instructions.
2. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.
3. Verify that water vapor emission from concrete and relative humidity in concrete are within limits established by coating manufacturer. See Section 09 05 61.
4. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.

3.04 PROTECTION

A. Protect installed floors until chemical reaction process is complete; at least three months.
   1. Comply with precautions listed under FIELD CONDITIONS.
   2. Clean floor regularly in accordance with manufacturer's recommendations.
   3. Clean up spills immediately and spot-treat stains with degreaser or oil emulsifier as recommended by the flooring manufacturer.

END OF SECTION

SECTION 03 45 00
PRECAST ARCHITECTURAL CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural precast concrete accessories.

1.02 RELATED REQUIREMENTS

A. Section 04 20 00 - Unit Masonry: Associated masonry requirements.

B. Section 07 90 05 - Joint Sealers: Perimeter joints with sealant and backing.

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

1.03 REGULATORY REQUIREMENTS

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

1.04 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).

B. ACI SPEC-301 - Specifications for Concrete Construction; 2020.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.

D. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2019.

E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.

F. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2022.

G. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).

H. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.

I. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021.

J. PCI MNL-117 - Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products; 2013.

K. PCI MNL-120 - PCI Design Handbook; 2017, with Errata (2021).

L. PCI MNL-122 - Architectural Precast Concrete: Fully Revised Manual Including New Sections, Extensive Updates, and Detailed Specifications to Meet Today's Construction Needs.; 2007.

M. PCI MNL-123 - Connections Manual: Design and Typical Details of Connections for Precast and Prestressed Concrete; 1988.

N. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction; 2000.

1.05 PERFORMANCE REQUIREMENTS

A. Provide the following test results to prove satisfactory strength & durability factors:
   1. Strength: Minimum 5,000 PSI at 28 days, average of two 4” or 6” diam. cylinder breaks, tested per ASTM C39.
   2. Absorption: No more than 6% by weight
   3. Air Content: 4% - 8%

4. Freeze Thaw: No more than 2% weight loss after 300 cycles. Producer must have a typical mix design freeze/thaw test result on file, recent within 24 months.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's information on accessory products, including pigments, admixtures, inserts, plates, etc.

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: Detail fabrication and installation of architectural precast concrete units. Indicate layout, unit locations, plans, elevations, shapes, cross sections of each unit, configuration, unit identification marks, reinforcement, connection details, support items, dimensions, openings, and relationship to adjacent materials. Indicate joints, reveals, and extent and location of each surface finish. Indicate details at building corners & any transition locations.
   1. Indicate welded connections by AWS standard symbols, if required. Detail loose and cast-in hardware and connections.
   2. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
   3. Indicate locations, extent, and treatment of dry joints if two-stage casting is proposed.
   4. Include plans and elevations showing unit location and sequence of erection (for special conditions).
   5. Indicate location of each architectural precast concrete unit by same identification mark placed on panel.
   6. Indicate relationship of architectural precast concrete units to adjacent materials.
   7. Indicate locations and details of precast units, including corner units and special shapes, and joint treatment, if required.
   8. Indicate locations and details of precast unit facings, anchors, and joint widths, if required.
   9. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.
   10. Provide a comprehensive engineering analysis for both reinforcement and anchoring that is stamped by a qualified professional engineer responsible for its preparation. Show governing panel types, connections, and types of reinforcement, including special reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame from the architectural precast concrete

E. Mix Design(s): For each precast concrete mixture required. Include past compressive strength and water-absorption tests for the proposed color, if available.
   1. Cement(s) used for approved mix design, including material test results.
   2. Aggregates used for approved mix design, including material test results.
   3. Pigments used in proposed / approved mix design.
   4. Admixtures to be used in proposed / approved mix design.
   5. Reinforcing Materials proposed for project.

F. Samples: Provide a standard range of precast samples for the Design Team’s review. All options should provide an accurate representation of the color & finish of the materials, as required per contract documents. Additional samples may be requested by the Design Team, if necessary. Once a color is selected the Design team may request larger samples or mock-up piece (s).
   1. Joint treatment samples required (by Installer):
      a. Grout / Mortar.

b. Sealant / Caulking.

G. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

H. Maintenance Data: Indicate surface cleaning and maintenance waterproofing instructions.

1.07 QUALITY ASSURANCE

A. Design Engineer Qualifications: Design precast concrete units under direct supervision of a Professional Structural Engineer experienced in design of precast concrete and licensed in the State in which the Project is located.

B. Installer Qualifications:
1. Firm having at least ten years of experience in installation of precast concrete of the type required.
a. Design Team may require a "Certified Field Auditor" to conduct a field audit of a past project (in same category as this Project) before erection of precast concrete, in order to produce & submit an Erectors' Post-Audit Declaration.

C. Fabricator Qualifications: A firm that assumes responsibility for drawing and manufacturing architectural precast concrete units that comply with performance requirements. This responsibility includes preparation of Shop Drawings and Comprehensive Engineering Analysis by a qualified professional engineer:
1. Firm having at least ten years of documented experience in production of precast concrete of the type required.
2. Plant certified under Architectural Precast Association Plant Certification Program for production of architectural precast concrete.
3. QC Manual on file, available for review at the production facility upon request.

D. Testing Agency Qualifications: An independent testing agency qualified to perform the testing indicated according to ASTM C1077 & ASTM E329 and retains a current certification through

E. Design Standards: Comply with ACI 318 and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.

F. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."

G. Welding: Qualify procedures and personnel according to AWS D1.1/D.1.1M, "Structural Welding Code - Steel"; and AWS D1.4, "Structural Welding Code - Reinforcing Steel."

H. Pre-installation Conference: Conduct conference / meeting on site to discuss and confirm compliance with contract documents & project schedule.

1.08 SOURCE QUALITY CONTROL

A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements.

B. If using self-consolidating concrete, test and inspect according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants."

C. Owner reserves the right to employ an independent testing agency to evaluate architectural precast concrete fabricator's quality-control and testing methods.
1. Allow Owner's testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with Owner's testing agency and provide samples of materials and concrete mixtures as may be requested for additional testing and evaluation.

D. Strength of precast concrete units will be considered deficient if units fail to comply with ACI 318 (ACI 318M) requirements for concrete strength.

E. Testing: If there is evidence that strength of precast concrete units may be deficient or may not comply with ACI 318 (ACI 318M) requirements, precaster will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42/C 42M.
   1. A minimum of three representative cores will be taken from units of suspect strength, from locations directed by Architect.
   2. Cores will be tested in an air-dry condition.
   3. Strength of concrete for each series of 3 cores will be considered satisfactory if average compressive strength is equal to at least 85 percent of 28-day design compressive strength and no single core is less than 75 percent of 28-day design compressive strength.
   4. If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.

F. Test results to be on file at the Plant and made available to the Architect, Contractor, EOR and Owner upon request. Test reports will include the following:
   1. Project identification name and number.
   2. Date when tests were performed.
   3. Name of precast concrete fabricator.
   4. Name of concrete testing agency.

1.09 MOCK-UPS

A. Mock-Up Sample Panel(s): As indicated on Drawings.
   1. Provide panels where indicated or, if not indicated, as directed by Architect.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents unless such deviations are specifically approved by Architect in writing.
   3. If requested, damage part of an exposed-face surface for each finish, color, and texture, and perform a repair to demonstrate expectation of repairs on the project.
   4. Demolish and remove sample panels when directed.

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

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver architectural precast concrete units in an organized, prioritized manner at such times to limit unloading requirements and increase efficiency on site.

B. Support units during shipment on non-staining, shock-absorbing material, when possible.

C. Palletize & store units with adequate dunnage / bracing and protect units to prevent staining, cracking, distortion, warping or other physical damage or aesthetic defects.

D. Place stored units so identification marks are clearly visible, so units can be inspected and quantified.

E. Unload, handle, store and transport units in a position consistent with their shape and design in order to avoid excessive stresses which would cause cracking or damage.

F. Lift and support units in a manner that minimizes risk of cracking or damage.

G. Remove steel banding from pallets while being stored, to reduce the risks of rust stains.

H. Cover Precast materials during storage to protect from staining & discoloration from weather and construction site debris / activity.

1.11 SEQUENCING

A. Furnish all precast materials and any loose connection hardware and anchorage items without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Architectural Precast Concrete Fabricators:
   1. Northern Design; 51 International Drive, Loudon, NH 03307.
   2. Approved Equal:
      a. APA Certified Plant who is capable to provide the products required for project at hand.
      b. Producer to submit product data & qualifications for preliminary approval.
      c. Producer to provide a list of past projects for Design Team's review.
   3. Other Acceptable Fabricators; acceptable if meeting qualification as specified in this section.
      a. Precast Specialties Corporation; 999 Adams Street, Abington, MA 02351.
      b. Architectural Precast Innovations, Inc.; 3369 Paxtonville Road, Middleburg, PA 17842.

2.02 PRECAST UNITS, GENERAL

A. Precast Architectural Concrete Units: Comply with PCI MNL-120, PCI MNL-122, PCI MNL-123, PCI MNL-135, and ACI CODE-318.
   1. Concrete: Minimum 5000 psi, 28 day strength, air entrained to 5 to 7 percent; comply with ACI SPEC-301.
   2. Design Loads: Static loads, anticipated dynamic loading, including positive and negative wind loads, thermal movement loads, and erection forces as defined by applicable code.
   3. Calculate structural properties of units in accordance with ACI CODE-318.
   4. Accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
   5. Provide connections that accommodate building movement and thermal movement and adjust to misalignment of structure without unit distortion or damage.

2.03 FINISHES

A. Standard Finishes: Exposed to view faces shall be free of joint marks, grain, and other obvious defects. All finished faces to be treated in a manner that creates consistency from face to face, piece to piece, day to day. All exposed-to-view surfaces of architectural precast concrete units to match approved sample and mock-up panel, if applicable.
   1. Sills and miscellaneous caps and trims:
      a. Standard Light Acid Etch Finish: Use adequate equipment and application techniques of acid and water to expose aggregate and surrounding matrix surfaces in a consistent manner. Thoroughly clean units from all acid residue.

B. Finish all exposed surfaces of architectural precast concrete units to create an attractive, consistent appearance.

C. One face is always troweled. If exposed, that surface must be steel troweled as smooth as possible and finished in a manner that minimizes the visual inconsistency of a trowel finish.

D. All unexposed surfaces of architectural precast concrete units as "as cast", no finishing.

2.04 MOLD MATERIALS

A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.

1. Mold-Release Agent: Commercially produced liquid-release agent that will not bond with, stain or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

B. Form Liners: If required by contract documents, furnish form liners with manufacturer's recommended liquid-release agent that will not bond with, stain, or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

C. Surface Retarder: Chemical set retarder, capable of temporarily delaying final hardening of newly placed concrete mixture to depth of reveal specified.

2.05 REINFORCEMENT

A. Reinforcing Steel: ASTM A615, Grade 60 (60,000 psi).
1. Deformed billet-steel bars.
2. Galvanized in accordance with ASTM A767/A767M, Class I.

B. Steel Welded Wire Reinforcement (WWR): Galvanized, plain type, ASTM A1064/A1064M.
1. Form: Flat Sheets.
2. WWR Style: 4 X 4 W4/W4..

2.06 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I - Normal Portland type.

B. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C33. Stockpile course and fine aggregates from a single source (pit or quarry) for entire Project.
1. Coarse Aggregates: Selected, consistent, hard, and durable; free of material that reacts with cement or causes staining:
a. Size / Gradation: ½" diameter Ledge Rock -- 12.5 mm per ASTM C33
2. Fine Aggregates: Selected, consistent, natural or manufactured sand of same material as coarse aggregate, unless otherwise approved by Architect.
a. Concrete Sand per ASTM C33

C. Waterproofing Admixture: Single component, liquid, inorganic admixture free of volatile organic compounds (VOCs); reacts with cementitious material to integrally and permanently close route of moisture transmission.
1. Product:
a. GCP Applied Technologies; Darapel.
b. Substitutions: See Section01 60 00 - Product Requirements.

D. Color Additives: Pure, concentrated mineral pigments specifically intended for mixing into concrete and complying with ASTM C979.
1. As required to achieve color to match existing sills.
2. Concentration: Base dosage rates on weight of Portland cement, fly ash, silica fume, and other cementitious materials but not aggregate or sand.
3. Color(s): As selected by Architect from manufacturer's full range.
a. Allow for one pigment colors, as selected by Architect.

E. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

F. Air Entrainment Admixture: ASTM C260/C260M, certified by manufacturer to be compatible with other required admixtures.

G. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture. Include product data for all admixtures that will be included in proposed mix design:
1. Water-Reducing Admixtures: ASTM C 494/C 494M, Type A.Retarding Admixture: ASTM C 494/C 494M, Type B.Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.

2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
5. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
7. Plasticizing Admixture: ASTM C 1017/C 1017M, Type I.
8. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
9. Corrosion Inhibiting Admixture: ASTM C 1582/C 1582M.

2.07 SUPPORT DEVICES

A. Connecting and Support Devices; Anchors and Inserts: ASTM A666 Type 304 stainless steel.
   1. Clean surfaces of rust, scale, grease, and foreign matter.

B. Stainless-Steel Bolts and Studs: ASTM F 593, Alloy 304 or 316, hex-head bolts and studs; stainless-steel nuts; and flat, stainless-steel washers.
   1. Lubricate threaded parts of stainless-steel bolts with an antiseize thread lubricant during assembly.

C. Stainless-Steel-Headed Studs: ASTM A 276, with minimum mechanical properties of PCI MNL 117, Table 3.2.3.

2.08 CONCRETE MIXTURES

A. Prepare mix designs for each precast concrete color / sample required.

B. Design mixtures to be prepared by APA Batch Plant Operator who is actively employed at architectural precast concrete fabricator's APA Certified facility.

C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 or PCI MNL 117 when tested according to ASTM C 1218/C 1218M.

D. Normal-Weight Concrete Mixtures: Proportions confirmed by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
   1. Compressive Strength (28 Days): 5000 psi (34.5 MPa) minimum.
   2. Maximum Water-Cementitious Materials Ratio: 0.45.

E. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to PCI MNL 117.

F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.

G. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

2.09 FABRICATION

A. Fabricate in compliance with PCI MNL-117 and PCI MNL-135.

B. Mold Fabrication:
   1. Accurately construct molds, water tight, of sufficient strength to withstand pressures due to concrete-placement operations, material weight and temperature changes. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement by release agent.
   2. Use rigid molds, constructed to maintain precast unit uniform in shape, size, and finish.
   3. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concrete placement. Coat form liner with form-release agent.
   4. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.

a. Form joints are not permitted on faces exposed to view in the finished work.
b. Edge and Corner Treatment: Uniformly sealed, chamfered or radiused, as required by Contract Documents.

C. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."

D. Installer to furnish loose hardware items including steel plates, clip angles, seat angles, strap anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.

E. Cast-in reglets, slots, pin pockets, voids, and any other accessories in the architectural precast concrete units, as indicated on the Contract Drawings.

F. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.
1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcing exceeds limits specified in ASTM A 775/A 775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
3. Place reinforcement to maintain at least 3/4-inch (19-mm) minimum coverage. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
4. Place reinforcing steel to maintain at least 3/4-inch (19-mm) minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches (38 mm) when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete, if necessary. Direct wire tie ends away from finished, exposed concrete surfaces.
5. Install welded wire fabric in lengths as long as practical. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.

G. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses.

H. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.

I. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch (25 mm) or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.

J. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units.
1. Place backup concrete mixture to ensure bond with face-mixture concrete.

K. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air on surfaces. Use equipment and procedures complying with PCI MNL 117.

1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants."

L. Comply with PCI MNL 117 for hot- and cold-weather concrete placement.

M. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that will not show in finished structure.

N. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

O. Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and Architect's approval

2.10 FABRICATION TOLERANCES

A. Comply with PCI MNL-117 and PCI MNL-135, except as specifically amended below.
1. Maximum Variation From Nominal Face Dimensions: Plus or minus 3/32 in.
2. Maximum Variation From Square or Designated Skew: Plus or minus 1/8 inch in 10 feet.
3. Maximum Variation from Thickness: Plus or minus 1/8 in.
4. Maximum Bowing of Members: Plus or minus length/360.

2.11 SOURCE QUALITY CONTROL

A. Provide testing of concrete mix.

PART 3 EXECUTION

3.01 EXAMINATION

A. Installer to examine supporting structural frame, foundation, back-up, opening sizes and location, bearing surfaces are true and level and any other conditions affecting the ability to install / erect with full compliance to contract documents.

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

C. Do not install precast concrete units until supporting cast-in-place building structural framing has attained minimum allowable design compressive strength or supporting steel or other structure is complete.

3.02 INSTALLATION

A. Install clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members and backup materials.

B. Erect architectural precast concrete level, plumb, and square within specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment as units are being permanently connected.
1. Install temporary steel or plastic spacing shims or bearing pads as precast concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
3. Remove projecting lifting devices and grout fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
4. Unless otherwise indicated, maintain uniform joint widths of 3/8 inch (10 mm).

C. Connect architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.
   1. Do not permit connections / anchors to disrupt continuity of flashing or jeopardizing the design team's waterproofing design efforts.

D. Welding: Comply with applicable AWS D1.1/D1.1M and AWS D1.4 for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.
   1. Protect architectural precast concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
   2. Welds not specified shall be continuous fillet welds, using no less than the minimum fillet as specified by AWS.
   3. Clean weld-affected metal surfaces with chipping hammer followed by brushing, and apply a minimum 4.0-mil- (0.1-mm-) thick coat of galvanized repair paint to galvanized surfaces according to ASTM A 780.
   4. Clean weld-affected metal surfaces with chipping hammer followed by brushing, and re-prime damaged painted surfaces.
   5. Remove, re-weld, or repair incomplete and defective welds.

E. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.
   1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot. For friction connections, apply specified bolt torque and check 25 percent of bolts at random by calibrated torque wrench.

F. Grouting Connections: Grout connections where required or indicated. Retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.

3.03 ERECTION TOLERANCES

A. Erect architectural precast concrete units level, plumb, square, true, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.

B. Erect architectural precast concrete units level, plumb, square, and true, without exceeding the following noncumulative erection tolerances:
   1. Plan Location from Building Grid Datum: Plus or minus 1/2 inch (13 mm).
   2. Plan Location from Centerline of Steel: Plus or minus 1/2 inch (13 mm).
   3. Top Elevation from Nominal Top Elevation: As follows:
      a. Exposed Individual Panel: Plus or minus 1/4 inch (6 mm).
      b. Non-Exposed Individual Panel: Plus or minus 1/2 inch (13 mm).
      c. Exposed Panel Relative to Adjacent Panel: 1/4 inch (6 mm).
      d. Non-Exposed Panel Relative to Adjacent Panel: 1/2 inch (13 mm).
   4. Support Elevation from Nominal Support Elevation: As follows:
      a. Maximum Low: 1/2 inch (13 mm).
      b. Maximum High: 1/4 inch (6 mm).
   5. Maximum Plumb Variation over the Lesser of Height of Structure or 100 Feet (30 m): 1 inch (25 mm).
   6. Plumb in Any 10 Feet (3 m) of Element Height: 1/4 inch (6 mm).
   7. Maximum Jog in Alignment of Matching Edges: 1/4 inch (6 mm).
   8. Joint Width (Governs over Joint Taper): Plus or minus 1/4 inch (6 mm).
   9. Maximum Joint Taper: 3/8 inch (10 mm).
   10. Joint Taper in 10 Feet (3 m): 1/4 inch (6 mm).

11. Maximum Jog in Alignment of Matching Faces: 1/4 inch (6 mm).
12. Differential Bowing or Camber, as Erected, between Adjacent Members of Same Design: 1/4 inch (6 mm).
13. Opening Height between Spandrels: Plus or minus 1/4 inch (6 mm).

3.04 FIELD QUALITY CONTROL

A. Special Inspections: Owner may choose to engage a qualified special inspector to perform the following special inspections and prepare reports:
   1. Accurate erection of precast concrete members.
   2. Validate anchoring materials & execution.

B. Testing Agency: Owner may choose to engage a qualified testing agency to perform tests, inspections and prepare reports.

3.05 REPAIRS

A. Repair architectural precast concrete in a durable manner that minimizes the visual impact of said damage. The Architect reserves the right to reject repairs that do not comply with requirements.

B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet (6 m).

C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780.

D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.

E. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.06 CLEANING

A. Clean surfaces of precast concrete units exposed to view.

B. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.

C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
   1. Perform cleaning procedures according to precast concrete fabricator's recommendations. Clean soiled precast concrete surfaces with detergent and a hot power wash. Always use a fanned spray, no stream power washing that can leaves line on the finished product.
   2. Use a stiff fiber brush and / or sponge with clean water, if necessary. Protect other work from staining or damage due to cleaning operations.
   3. Use a masonry cleaning detergent with water, if necessary. Rinse heavily and continuously in order to avoid changing the finish of the finished product.

END OF SECTION

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. Cementitious Underlayment, For Exposed Applications: Blended cement mix, that when mixed with water in accordance with manufacturer's directions will produce self-leveling underlayment.
   1. Compressive Strength, ASTM C1708, C109: Minimum 6000 psi after 28 days.
   2. Flexural Strength, ASTM C1708, C348: Minimum 1,200 psi after 28 days.
   3. Density: 125 lb/cu ft, nominal.
   4. Thickness: Capable of thicknesses from feather edge to maximum 3-1/2 inch.
   5. Products:
      a. Ardex Engineered Cements; SD-T.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Water: Potable and not detrimental to underlayment mix materials.

D. Primer: Manufacturer's recommended type.

E. 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 04 01 00
MAINTENANCE OF MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water cleaning of existing masonry surfaces.

1.02 RELATED REQUIREMENTS

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

1.03 REFERENCE STANDARDS

A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

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 at least two weeks prior to commencing work of this Section following successful submission of all required product information and shop drawings.
   1. Require attendance of parties directly affecting work of this Section.
   2. Review full scope of work.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on cleaning compounds.

C. Product Data: Provide manufacturer's product data and MSDS sheets on CFRP systems, including physical and chemical characteristics, material specifications for each component, limitations on use of system, construction or application instructions, maintenance instructions, and general manufacturer's recommendations regarding each system.

D. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.

E. Manufacturer's Instructions: For cleaning materials, indicate special procedures, conditions requiring special attention.

1.07 QUALITY ASSURANCE - MASONRY WORK

A. Restorer: Company specializing in masonry restoration with minimum of ten years of documented experience.

1.08 MOCK-UPS

A. Clean a 10 ft by 10 ft panel of wall to determine extent of cleaning.

B. Locate where directed. Re-do or modify mock-up until acceptance by Architect and Owner is achieved.

C. Acceptable panel and procedures employed will become the standard for work of this Section.

D. Accepted mock-ups may remain as part of the Work.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Store materials in covered, well-ventilated area protected from exposure to detrimental conditions, including airborne contaminants, dirt, dust, sunlight, temperatures lower than 40 degrees F or greater than 100 degrees F, rainfall, sparks, or flame, and in accordance with the manufacturer's requirements. Store polymer resins and hardeners in separate area from construction materials that can absorb odors.

PART 2 PRODUCTS

2.01 CLEANING MATERIALS

A. Restoration and Cleaning Chemicals:
   1. Cleaning Agent: Detergent type.
   2. Products:
      a. Diedrich Technologies, Inc; Product 101 Masonry Restorer Super Concentrate:
      b. PROSOCO; Product EK Restoration Cleaner.
      c. Substitutions: See Section 01 60 00 - Product Requirements.
         (a) Cleaning products recommended by the masonry manufacturers may be submitted to the Architect for consideration. However, the masking of other products, ensuring compatibility with other products, ensuring no damage to surrounding work, and ensuring compatibility with coatings and painting is the responsibility of the General Contractor.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces to be cleaned are ready for work of this Section.

3.02 SCOPE OF MASONRY CLEANING.

A. All existing exterior masonry surfaces to be exposed to interior portions of the building addition shall be cleaned in accordance with this Section.

3.03 PREPARATION

A. Protect surrounding elements from damage due to restoration procedures.

B. Separate areas to be protected from restoration areas using means adequate to prevent damage.

C. Cover existing landscaping with tarpaulins or similar covers.

D. Mask immediately adjacent surfaces with material that will withstand cleaning and restoration procedures.

E. When using cleaning methods that involve water or other liquids, install drainage devices to prevent runoff over adjacent surfaces unless those surfaces are impervious to damage from runoff.

F. Do not allow cleaning runoff to drain into sanitary or storm sewers.

3.04 CLEANING EXISTING MASONRY

A. Cleaning Detergent: Brush clean masonry surfaces at all existing masonry to be exposed in interior portion of addition locations with cleaning agent in accordance with the manufacturer's instructions. Saturate masonry with clean water and flush loose mortar and dirt.

3.05 RESTORATION CLEANING

A. Clean surfaces and remove large particles with wood scrapers or non-ferrous wire brush.

B. Spray or Brush coat masonry with restoration cleaner, mixed into solution in accordance with manufacturer's instructions.

C. Provide a second application if required to match mock-up area.

D. Allow sufficient time for solution to remain on masonry and agitate with soft fiber brush or sponge.

E. Rinse from the bottom up with potable water applied at 400 psi and at a rate of 4 gal/min.

F. High pressure washing is prohibited on masonry surfaces.

3.06 CLEANING

A. Immediately remove stains, efflorescence, or other excess resulting from the work of this Section.

B. Remove excess mortar, smears, and droppings as work proceeds and upon completion.

C. Clean surrounding surfaces.

SECTION 04 20 00
UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Facing brick.

B. Thermal break block, solid units in both standard and field cut sizes.

C. Mortar and grout.

D. Reinforcement.

E. Masonry ties.

F. Flashings.

G. Building-in of lintels, bearing plates, anchors, and items supplied by other trades.

H. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Reinforcing dowels with foundation.

B. Section 05 40 00 – Cold-Formed Metal Framing: Framing of back-up walls.

C. Section 05 12 00 – Structural Steel Framing: Loose steel lintels.

D. Section 06 10 54 - Wood Blocking and Curbing: Blocking and nailers at masonry.

E. Section 07 21 00 - Thermal Insulation: Insulation for cavity spaces.

F. Section 07 25 00 - Weather Barriers: Water-resistive barriers applied to exterior face of backing sheathing or unit masonry substrate.

G. Section 07 90 05 - Joint Sealers: Backing rod and sealant at control and expansion joints; compressible fillers at relieving angles.

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

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2023a.

C. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2023.

D. ASTM A580/A580M - Standard Specification for Stainless Steel Wire; 2023.

E. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019.

F. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.

G. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2022.

H. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale); 2023.

I. ASTM C91/C91M - Standard Specification for Masonry Cement; 2023.

J. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2023.

K. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2023.

L. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.

M. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

N. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.

O. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); 2023.

P. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.

Q. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2024.

R. ASTM C476 - Standard Specification for Grout for Masonry; 2023.

S. ASTM C780 - Standard Test Methods for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2023.

T. ASTM C1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength; 2022.

U. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2023a.

V. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry; 2019a.

W. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2017 (Reapproved 2023).

X. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry; 2020.

Y. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.

Z. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls; 2005.

AA. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

BB. 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 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting at least one month before starting work of this Section; require attendance by all relevant installers.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, masonry accessories, premixed parge coat and all other specified 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. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories for brickwork support system.

1. Submit shop drawings of all masonry reinforcement detailing fabrication, bending, and placement of unit masonry reinforcing bars. Comply with ACI 315 - Details and Detailing of Concrete Reinforcing, showing bar schedules, stirrup spacing, lap lengths, diagrams of bent bars, and arrangement of masonry reinforcement, including elevations of all

reinforced walls. Wall elevations shall include reinforcing at all architectural and mechanical openings.

2. Submit shop drawings of all special masonry shapes. Shop drawings shall indicate types of materials, finishes, dimensions, and anchorage. Shapes shall be represented in plan, elevation, and related details.
3. Submit shop drawing plan indicating proposed locations of all construction joints in masonry walls.

E. Samples:
1. Submit five samples of decorative block units to illustrate color, texture, and extremes of color range.
2. Submit samples of each type of reinforcement, ties, anchors, flashing, expansion joints, joint fillers, weeps, etc.

F. Manufacturer's Certificate: Submit prior to delivery of materials to the job site. Certify that masonry units meet or exceed specified requirements.

G. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.

H. Mix Designs and Test Reports: Submit independent testing lab certificates:
1. Mortar mix designs and test results including proportions and mortar ingredients, prepared in accordance with ASTM C270.
2. Grout mix designs and test results including description of type and proportions of grout ingredients, prepared in accordance with ASTM C476.
3. Masonry units compression, absorption and measurement test result.

1.07 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the Construction Documents.

B. Pre-construction Testing: If manufacturers' published test reports are not available, the Contractor shall employ and pay an approved testing laboratory to perform pre-construction testing for:
1. For exposed brick, include test report for efflorescence in accordance with ASTM C67/C67M.
2. Prism tests for each type of wall construction per ASTM E447.
3. Mortar testing per ASTM C780.
4. Grout compressive strength testing per ASTM C1019.

C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum ten years of documented experience.

D. Installer Qualifications: Company specializing in performing work of the type specified and with at least ten years of documented experience.

1.08 MOCK-UPS

A. In Place Mock-Up Panel: Construct an exterior wall mock-up panel; including all components typical to the exterior wall construction, including but not limited to both types of facing brick units, mortar and accessories and flashings metal studs, sheathing, weather barrier, sealant, metal wall panel, windows, and insulation.
1. Mock-up panel shall be constructed in a timely manner to allow for review and modifications if necessary prior to start of any related construction
2. Locate mock-up panel where directed by Architect.
3. Mock-up panel shall be of proper thickness, showing proposed masonry color range, texture, bond, mortar joint and workmanship, proper installation of various wall components, relationship of mortar and sealant colors to stone colors; tooling of joints; and aesthetic qualities of workmanship. No work shall progress until the Architect has reviewed

the mock-up panel. Panel shall be revised as necessary to secure the Architect's acceptance.

a. The mock up panel shall illustrate typical wall structure encompassing a point 6 inches below the base wall sub-grade weep detail to the finish roof coping. The sub-grade detail shall be left exposed to permit review of drainage performance.

4. Mock-up panel shall then become the standard of comparison for all masonry work built of the same material. The panel shall not be destroyed or moved until the Work is complete and accepted by the Architect.
5. Mock-up may remain as part of the Work.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.
   1. The maximum moisture content of concrete block when laid shall not exceed 30% for exterior exposures and 25% for interior exposures (as a percent of total absorption and is in addition to moisture level required under ASTM C90).

B. All mortar materials shall be stored under cover in a dry place.

C. Reinforcement steel, ties, and anchors shall be protected from the elements and, before being placed, shall be free from loose rust and other coating, including ice that will destroy or reduce the bond.

PART 2 PRODUCTS

2.01 BRICK UNITS

A. Brick Veneer, Type 1:
   1. Facing Brick: ASTM C216, Type FBS, Grade SW.
   2. Unit size: Modular; 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
   3. Special Shapes: Provide corner pieces and other custom profiles as indicated in the Drawings.
   4. Bonds and Patterns: As indicated on the Drawings.
   5. Unit Compressive strength, ASTM C67: 8,000 psi average.
   6. Efflorescence, ASTM C67: Not effloresced.
   7. Absorption, ASTM C67, initial rate: 30 grams per 30 sq. in. per minute.
   8. Basis of Design; To match existing building:
      a. Morin Brick Company; College Blend, Waterstruck.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Brick Veneer, Type 2:
   1. Facing Brick: ASTM C216, Type FBS, Grade SW.
   2. Unit size: Modular; 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
   3. Special Shapes: Provide corner pieces and other custom profiles as indicated in the Drawings.
   4. Bonds and Patterns: As indicated on the Drawings.
   5. Unit Compressive strength, ASTM C67: 8,000 psi average.
   6. Efflorescence, ASTM C67: Not effloresced.
   7. Absorption, ASTM C67, initial rate: 30 grams per 30 sq. in. per minute.
   8. Basis of Design; To match existing building:
      a. Endicott Clay Products Company; Dark Iron Spot, Velour.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Basis of Design Manufacturer: As indicated above.
   1. Alternate Manufacturers; any substitutions shall be proposed during bidding as an RFI for Owner and Architect review.
      a. Morin Brick
      b. Belden Brick.

c. Glen Gery Brick.
d. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 THERMAL BREAK BLOCK UNITS

A. Thermal Break Block: High-strength polyurethane thermal break:
1. Application: Bottom course of brick veneer on concrete brick shelf, to maintain continuous insulation of building envelope.
2. Compressive Strength, ASTM D1621: 2,100 psi.
3. Compression Modulus, ASTM D1621: 49,300 psi.
4. Shear Strength, ASTM C273: 310 psi.
5. Linear Thermal Expansion Maximum, ASTM E831: 25 x 10e-6 in/in/degree F.
6. Thermal Resistance (R value), ASTM C518: 1.9 ft2 ·°F·h/BTU
7. Sizes:
a. Thickness: 2 inches, unless otherwise indicated.
b. Width: As indicated in the Drawings.
8. Product:
a. Armatherm; 500-280 Structural Thermal Break Material.
b. General Plastics; R-9340HP.
c. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 MORTAR AND GROUT MATERIALS

A. Packaged Dry Material for Mortar for Unit Masonry: Premixed masonry cement and mason's sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
1. Mortar for UL Design CMU: Comply with UL design requirements
2. Exterior masonry veneer: Type N.
3. Masonry below grade and in contact with earth: Type S.
4. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
a. Color: Mineral pigments added complying with ASTM C979/C979M as required to produce approved color sample.
1) Provide up to two colors, as indicated below, designations based on Basis of Design product.:
(a) Grout 1: To be selected by Architect.
(b) Grout 2: To be selected by Architect.
5. Manufacturers:
a. Spec-Mix.
b. Sakrete.
c. Amerimix, an Oldcastle Company.
d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Water: Clean and potable.

C. Admixtures: Admixtures shall not be used without the Architect's written permission, unless specified herein.

D. Grout: ASTM C476, 3,000 psi minimum 28-day compressive strength. Consistency required to fill completely volumes indicated for grouting.
1. Fine grout shall be used for spaces less than 2” in either horizontal dimension.
2. Mortar shall be used for spaces less than ¾” in width or spaces less than 1-1/2” x 2” in horizontal dimensions.
3. Coarse Grout shall be used for filling cavities 2” or larger in width or cells 2” x 3” or larger in horizontal dimensions.
4. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.

E. Mixing: Use mechanical batch mixer and comply with referenced standards.

F. Use of accelerating admixtures in cold weather and set-retarding admixtures during hot weather only when reviewed and approved by the Architect.

2.04 REINFORCEMENT AND ANCHORAGE

A. Masonry Veneer Anchors: 2-piece adjustable veneer anchor and pintel tie.
   1. Application: Typical exterior wall with continuous rigid insulation.
   2. Thermal Wing Nut Tie: Single screw veneer tie with dual diameter type 304 stainless steel barrel and factory EPDM washers at insulation faces and at the weather barrier. Barrel with 5/16" hex head, length to accommodate insulation. Projecting Thermal Wings are steel reinforced and coated with highly flame resistant plastic to create a thermal break, decreasing thermal transfer through rigid insulation. The Wings accept a standard or seismic hook, spin to easily orient pintles/hooks to masonry joints, and provide up to 1/2” of adjustability to account for variations in wall thickness.
   3. Adjustable Wire Ties: 3/16 inch thickness, AISI type 304 stainless steel, per ASTM A580/A580M. Tie length shall be as required for a minimum 2" tie embedment in mortar.
   4. Seismic / Horizontal Joint Reinforcement Feature: Provide lip, hook, or clip on extended leg of wall ties to engage or enclose not less than one continuous horizontal joint reinforcement type 304 stainless steel wire of 0.1483 inch diameter.
   5. Basis of Design:
      a. Steel Stud Backup: Thermal 2-Seal Wing Nut Anchor by Hohmann & Barnard.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Single Strand Reinforcement (For brick sills, soldier course and stack bond): Continuous single strand, type 304 stainless steel, No. 9 gauge deformed wire.

C. Fasteners: Anchors shall be mechanically fastened to metal studs using self-drilling, self-tapping screws of sizes and types as recommended by the tie manufacturer. Screw finish shall be Type 304 stainless steel or a 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.

2.05 FLASHINGS

A. Thru-Wall Flashing: Stainless steel/polymer fabric flashing: ASTM A240/A240M stainless steel core with polymer fabric laminated to the bottom stainless steel face with non-asphalt adhesive. The top face (exposed side) must not be covered with a polymer fabric.
   1. Stainless steel: Type 304, ASTM A240, 2 mil thickness.
   2. Fabric: polymer fabric; laminated back face (non-exposed side) of stainless-steel core.
   3. Mastic/sealant, outside & inside corners, end dams, splice materials, termination bars, weep vent protection, fasteners and other accessories as required for a complete system per manufacturer specifications.
      a. Splice material: Product Basis of Design is York 304 SA by York. Manufacturer’s standard self-adhered metal material: material matching system material or use Multi-Flash SS 6” lap piece and polyether sealant as a splice.
   4. Size: Manufacturer's standard width rolls.
   5. Outside corner and inside corner material; manufacturer’s standard available units using:
      a. Preformed stainless steel: 26-gauge stainless steel.
   6. End dam: Product may be folded in line with the flashing material or utilize preformed end dams by manufacturer using:
      a. Preformed stainless steel: 26-gauge stainless steel
   7. Basis of Design: York Manufacturing Inc ; Multi-Flash SS.
   8. Alternate Manufacturers.
      a. STS Coatings, Inc.; Wall Guardian Stainless Steel TWF.
      b. Prosoco, Inc.; R-Guard SS ThruWall.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

B. Drip Flashing: Stainless Steel, ASTM A666, Type 304 alloy, soft temper, 26 gauge, 0.0217 inch thick; smooth No. 4 - Brushed finish. Continuous drip flashing, shape as indicated on the Drawings. Drip edge flashing shall extend into cavity to face of insulation to support thru-wall flashing. Terminate exterior edge with 30-degree 3/8" bent hemmed edge.

C. Miscellaneous Flashing: Stainless Steel, ASTM A666, Type 304 alloy, soft temper, 26 gauge, 0.0217 inch thick; smooth No. 4 - Brushed finish.

D. Termination Bars: Composite or Stainless steel, 26-guage; compatible with membrane and adhesives.
   1. Products:
      a. York Manufacturing, Inc; T-96 Termination Bar.
      b. Hohmann & Barnard, Inc.; T2 Termination Bar.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

2.06 ACCESSORIES

A. Wall Drainage Baffle: Polyester mesh panels designed for installation at flashing locations to prevent mortar droppings from clogging weeps. Size with of baffle to match depth of cavity.
   1. Products:
      a. Advanced Building Products Inc; Mortar Break DT.
      b. Mortar Net USA, Ltd.; Mortar Net.
      c. York Manufacturing, Inc; Weep Armor.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Cavity Vents: Polypropylene honeycomb, match brick joint height, color as selected by the Architect.
   1. Products:
      a. Dur-O-Wall; DA 1006 Cell Vent.
      b. Hohmann & Barnard, Inc.; Quadrovent.
      c. Mortar Net USA, Ltd.; Weep Vents.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

C. Bond Break: ASTM D226/D226M, Type I ("No.15") asphalt felt.

D. Compressible Filler: Closed cell neoprene sponge, ASTM D1056, black, thickness and width as required for joint.

E. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.
   1. Test solution on adjacent surfaces prior to full scale application. Mask and protect reactive materials from product splash, residue, wind drift and fumes.
   2. Apply in accordance with manufacturer instructions.
   3. Products:
      a. Prosoco; Safety Klean.
      b. Diedrich Technologies, Inc.; Eco-Scrub.
      c. Substitutions: See Section 01 60 00 - Product Requirements.
         1) Cleaning products recommended by the masonry manufacturers may be submitted to the Architect for consideration. However, the masking of other products, ensuring compatibility with other products, ensuring no damage to surrounding work, and ensuring compatibility with coatings and painting is the responsibility of the General Contractor.

F. Sealant: One part 100% solids, solvent-free formulated silyl-terminated polyether (STPE), ASTM C920-11, Type S, Grade NS, Class 50.
   1. Products:
      a. York Manufacturing Inc; UniverSeal US100.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

C. Steel sleeves shall be installed for all piping and cabling through masonry construction. Coordinate with Fire Protection, Plumbing, Mechanical and Electrical Divisions.

3.03 PROTECTON OF WORK

A. During erection, all walls shall be kept dry by covering at the end of each day or shutdown period with a strong, waterproof membrane. Partially completed walls not being worked on shall be similarly protected at all times. Covering shall completely cover all projecting rebar and overhang walls at least 2' on each side, and shall be securely held in place.

3.04 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

B. Freezing Weather
   1. Masonry units, cementitious materials, and sand shall be protected so that they are not wetted by rain, snow, or ground water.
   2. If ice or snow has formed on masonry bed, remove by carefully applying heat until top surface is dry to the touch. Remove all frozen or damaged masonry.
   3. Units with suctions in excess of 30g/min/30 sq. in. shall be sprinkled with heated water just prior to laying. Water temperature shall be above 70 degrees F. when units are above 32 degrees F. Water temperature shall be above 130 degrees F. when temperature of units is 32 degrees F. or below.
   4. High-early-strength Portland cement (Type III) shall be used in mortars during freezing weather. If Type I or II Portland cement is used, the protection period shall be increased from 24 hr. to 48 hrs. Mortar temperatures shall be kept less than 120 degrees F. to avoid flash set.
   5. Construction Requirements (masonry being worked on)
      a. Air Temperature 40 degrees F. to 32 degrees F.: Sand and mixing water shall be heated to produce mortar temperatures between 40 degrees F. and 120 degrees F.
      b. Air Temperature 32 degrees F. to 25 degrees F.: Sand and mixing water shall be heated to produce mortar temperatures between 40 degrees F. and 120 degrees F. Maintain temperatures of mortar on boards above freezing.
      c. Air Temperature 25 degrees F. and below: Sand and mixing water shall be heated to produce mortar temperatures between 40 degrees F. and 120 degrees F. Masonry units shall not be laid unless temporary heat is available. Air temperature shall be maintained above 32 degrees F. Windbreaks shall be employed when wind is in excess of 15 mph. Minimum surface temperature of units when laid shall be 20 degrees F.
   6. Protection Requirements (completed masonry or sections not being worked on).
      a. Mean Daily Air Temperature 40 degrees F. to 32 degrees F.: Masonry shall be protected from rain or snow for 24 hours.
      b. Mean Daily Air Temperature 32 degrees F. to 25 degrees F.: Masonry shall be completely covered for 24 hours.

c. Mean Daily Air Temperature 25 degrees F. and below: Masonry units shall not be laid unless heat is provided. Maintain masonry temperature above 32 degrees F. for 24 hours.

C. Hot Weather
1. In hot weather, when air temperatures exceed 90 degrees F, maintain the temperature of mortar and grout between 70 degrees F and 120 degrees F. Brick and sand shall be stored in a shaded area to control materials temperatures. Mortar spreading shall be limited to four (4') feet and masonry units shall be placed within one minute of spreading the mortar. If weather conditions create excessively fast evaporation conditions, completed walls shall be fog sprayed with water at the end of the day.

3.05 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. All masonry work shall be properly coordinated as required to maintain aligned coursing throughout the building, unless specifically noted otherwise.

D. Brick and Concrete Masonry Units:
1. Bond and Coursing: As indicated on drawings.
2. Mortar Joints: Concave, typical at exposed masonry; except in locations noted below.

E. Sealant Recesses: Outside joints around the perimeter of exterior door and window frames or other wall openings shall be not less than 3/8" nor more than 1/2" wide and shall be cleaned out to a uniform depth of at least 3/4" ready for placement of sealant by other trades.

3.06 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with full bed of mortar on head joints, bed joints, and webs.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar and mortar smears as work progresses.

E. Interlock intersections and external corners.

F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

3.07 FLASHING INSTALLATION

A. Coordinate the installation of all flashings in masonry in this Section, to ensure that all required flashings divert water to the exterior of the building.

B. Confirm compatibility with manufacturer’s mutual letters for all lapping components.

C. Install flashing after certified compatible weather barrier installation specified in Section 07 25 00 in accordance with manufacturer’s installation instructions.

D. Remove or cover protrusions or sharp edges that could puncture flashings.

E. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted. Extend flashings full width at such interruptions.

F. Install where indicated, specified, or required in accord with flashing manufacturer's written instructions and as follows.

G. Drip Flashing:

1. Drip flashing to extend across cavity between masonry and insulation to support thru-wall flashing.
2. Drip flashing shall be sealed to masonry and lintels below with a minimum of two beads of sealant.
3. Thru-wall flashing shall be sealed to drip flashing with minimum of two beads of sealant applied to surface of drip flashing prior to installation of thru-wall flashing. Sealant shall be applied to surface joint between drip edge and thru-wall flashing and tooled smooth. Immediately clean any sealant that will be visible in final installation.

H. Thru-wall flashing to be supported by continuous insulation or metal drip edge.

I. Thru-wall flashings shall extend from within 1/4 inch of exterior face of masonry, over drip flashing, across the cavity and turn up face of rigid insulation, turn at 45 degree angle through rigid insulation to wall sheathing and turn up vertical to specified flashing termination height.

J. Terminate thru-wall flashing on vertical surface of sheathing minimum 6 inches above the top of the wall drainage baffle:
1. Anchor vertical leg of flashing into backing with a termination bar and sealant.
2. Apply cap bead of sealant on top edge of self-adhered flashing.

K. Splice end joints by butting ends together over 6” wide piece of self-adhering stainless-steel flashing. The self-adhering stainless-steel flashing should be sealed metal face down on to the substrate with the mastic. Remove the release linear and butt the two pieces of flashing together and embed them into the splice sealant. Then seal the butt seam with sealant

L. Extend flashing 8" minimum, beyond opening. At ends of openings or horizontal flashing terminations use preformed end dams from manufacturer.

M. Seal lapped ends, butt joints and penetrations of flashing before covering with mortar.

N. Inside corners: Make in manufacturers accepted manner using preformed corners from manufacturer.

O. Outside corners: Make in manufacturers accepted manner preformed corners from manufacturer.

P. Cover flashing within a few days of installation to protect it from damage from the different trades, the environment and falling debris. If flashing is left unprotected and it is punctured, torn, or has loose scrim you should contact the manufacturer for repair instructions.

3.08 WEEPS/CAVITY VENTS

A. Install weeps in veneer and cavity walls at 16 inches on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom and top of walls, and where indicated on Drawings.

B. Weeps shall be directly in contact with thru-wall flashing to promote positive drainage. Mortar under the weeps is not permitted.

3.09 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.10 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 24 inches on center horizontally, but no greater than 2.67 sq ft of wall surface per anchor. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center, within 12 inches of all openings or panel ends, control joints or expansions joints.

B. Ties at stud walls shall be mechanically fastened to studs using corrosion resistant fasteners as specified.

C. Regularly inspect interior side of wall sheathing for fastener locations that are not contacting studs. Remove errant fasteners and seal in accordance with weather barrier manufacturer's instructions. Fill hole in continuous insulation with foam insulation sealant compatible with rigid insulation.

D. Masonry Veneer Horizontal Joint Reinforcement
   a. Place horizontal joint reinforcement in first and second horizontal joints above and below openings. Extend a minimum of 24 inches each side of opening, except where interrupted by vertical control joint.
   b. Place continuous joint reinforcement in first and second joint below top of walls.
   c. Lap joint reinforcement ends minimum 6 inches.
   d. Reinforcement shall be so placed as to assure a 5/8" minimum mortar cover on the faces of walls.

3.11 LINTELS

A. In general and except where indicated otherwise, masonry lintels shall be provided at all openings in CMU walls 6 inches (nominal) or more in thickness. See Structural Drawings for a schedule of masonry lintels.

B. Loose steel angle lintels shall be provided for all openings in brick veneer or as indicated on the Structural Drawings.

C. Maintain minimum 8 inch bearing on each side of opening, unless otherwise indicated.

D. Vertical cores below lintel ends shall be grouted solid full height to provide suitable bearing. Provide additional reinforcement and filled cores as indicated on the Drawings.

E. Temporarily brace lintels as required until mortar has adequately cured.

F. Bearing sides of loose steel lintels that traverse control joints shall be provided with thru wall flashing below the lintel on the side of lintel bearing. A slip plane is provided by the thru wall flashing above and below. The joint in front of the bottom leg of the lintel shall be provided with backer rod and sealant. In accordance with BIA Tech Note 18A, Accomodating Expansion on Brickwork.

3.12 GROUTED COMPONENTS

A. Place grout in accordance with ACI 530 and NCMA guidelines.

B. Grout mix and grout materials shall conform to ASTM C 476.

3.13 CUTTING AND FITTING

A. Cut and fit for chases, pipes, sleeves, and ductwork. Coordinate with other Sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.14 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Size control joint in accordance with Drawing details, but not less than 1/2" for installation of sealant and backer rod specified in Section 07 90 05. Keep joint free and clear of mortar. Install compressible joint filler during masonry installation to keep joint clear of mortar.

C. Build in horizontal, pressure relieving joints where indicated on the Drawings. Construct joints by inserting a compressible filler of width required and installing sealant and backer rod specified in Section 07 90 05 - Joint Fillers. Provide special shape lipped bricks to overlap edge of loose lintel and to keep a consistent horizontal joint. Locate horizontal, pressure

relieving joints beneath relieving (shelf) angles supporting masonry veneer and attached to structure behind masonry veneer.

D. Brick Veneer Control Joints: For exterior brick veneer masonry in general as follows:
   1. At locations not to exceed 20 feet o.c., or as otherwise indicated on the Drawings, whichever is less.
   2. Adjacent to corners of walls, with the sum of the distance to the corner at each wall totaling the typical joint spacing and no greater than 10’ from the corner.
   3. At changes in wall height.
   4. At wall offsets.
   5. Below relieving angles.
   6. Adjacent to openings as indicated on the Drawings.

3.15 TOLERANCES

A. Install masonry within the site tolerances found in TMS 402/602.

B. Maximum Variation from Alignment of Columns: 1/4 inch.

C. Maximum Variation from Unit to Adjacent Unit: 1/16 inch.

D. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft, 3/8 inch in any story and 1/2 inch in 40 feet or more.

E. Maximum Variation from Plumb at openings (windows, doors, etc): 1/8 inch in total height of opening.

F. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in 40 feet or more.

G. Maximum Variation from Level Coursing: 1/4 inch in any bay or 20 feet; 1/2 inch in 40 feet or more.

H. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

I. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.ft.

3.16 FIELD QUALITY CONTROL

A. The Owner shall employ and pay a qualified independent testing agency to perform construction testing on all locations of masonry during the first 1,000 square feet and at each additional 5,000 square feet of wall area, or as required by related codes and the Contract Documents or as directed by the Architect.
   1. Mortar: Mortar composition and properties shall be tested on randomly selected mortar samples. Tests shall be conducted in accordance with ASTM C780.
   2. Grout: Grout compressive strength shall be sampled and tested in accordance with ASTM C1019.
   3. Additional Testing: Work which testing or inspections indicate is not in conformance with the project requirements may require re-testing. When directed by the Architect, the Contractor shall engage and pay an approved testing laboratory to perform additional testing as necessary to reconfirm nonconformance of original work and compliance of corrected work.

B. Clay Masonry Unit Tests: Test each variety of clay masonry in accordance with ASTM C67 requirements, sampling 5 randomly chosen units for each 50,000 installed.

3.17 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. All exposed brick masonry to remain shall be thoroughly cleaned. Before applying any cleaning agent to the entire wall, it shall be applied to a sample wall area of approximately 20 sq. ft. in a location approved by the Architect. No further cleaning work may proceed until the sample area has been approved by the Architect, after which time the same cleaning materials and method shall be used on the remaining wall area. Adequate water shall be available to thoroughly pre-soak and rinse all surfaces to be cleaned.

E. All traces of excess mortar/grout, all efflorescence and all other construction stains shall be completely removed from exposed masonry.

3.18 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

B. Protect finishes until completion of project.

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. Leveling plates and anchor bolts.
2. Columns with base plates and connections.
3. Welding of plate washers at brace column base plates.
4. Beams with connections.
5. Channels, angles, plates, frames, anchors, and other similar pieces.
6. Moment connections.
7. Relieving angles and connections.
8. Steel bracing with connections.
9. Thermal isolation connections.
10. Shop paint and field touch-up paint after erection.
11. Galvanizing.
12. As-Built column and base plate surveys.

All structural steel that is exposed to view when the project is completed shall be Exposed to View Structural Steel (EVSS). Coordinate locations of all EVSS steel with Architectural and Structural Drawings.

B. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections:

1. Section 03 30 00 CAST-IN-PLACE CONCRETE: Anchor bolts, leveling plates, and structural steel shapes and plates embedded in concrete with anchors or headed studs, as indicated on the Drawings.

C. Items To Be Installed Only: Install the following items furnished by the designated Sections:

1. Section 03 30 00 CAST-IN-PLACE CONCRETE: Weldable threaded rebar couplers, as indicated on the Drawings.

1.03 RELATED SECTIONS

A. Related work shall be performed under the following Sections:

1. Section 03 30 00 CAST-IN-PLACE CONCRETE.

2. Section 05 12 26 SHEAR CONNECTORS.
3. Section 05 31 00 STEEL DECKING.
4. Section 05 50 00 METAL FABRICATIONS.
5. Section 07 81 00 APPLIED FIREPROOFING.
6. 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. Submittals requiring approval prior to Shop Drawing preparation:

1. Prior to preparation of the Shop Drawings, the steel fabricator shall have their representatives contact the Architect and Structural Engineer to discuss connection details, schedules, shop procedures, materials, and other concerns related to structural steel work.
2. Prior to preparation of Shop Drawings, the fabricator shall submit typical details and calculations for all structural steel connection types including, but not limited to, moment connections, beam to column, beam to girder, truss connections, column splices, beam splices, bracing connections, hanger connections, exposed connections, and other similar details, for approval by the Architect and Structural Engineer. Typical beam to beam, and beam to column connections shall be double angle type connections, unless otherwise shown on the Drawings. Approval of typical structural steel connection details and calculations shall be for general conformance with the requirements of the Contract Documents. Final approval of connections shall be subject to the review of the individual piece drawings.

3. Design of all connections is to be provided by the fabricator, under the supervision of a professional structural engineer, registered in the state in which the project is located. Design of all connections shall be in accordance with Allowable Stress Design (ASD) provisions. All connection design shall be subject to approval by the Architect.
4. Unless otherwise noted on the Drawings or below, member end connections shall be capable of supporting an end reaction equal to one half of the total uniform load derived from the AISC "Steel Construction Manual" Maximum Total Uniform Load Tables (3-6 through 3-9) for the particular beam size, span, and material grade specified.
    a. Consideration must be given to the additional load carrying capacity of composite steel members. Unless otherwise indicated, connections for composite beams shall be designed for at least 1.75 times the end reaction as determined above. Connections for composite girders shall be designed for at least 1.5 times the end reaction as determined above.
    b. Moment connections shall be designed to support the full ASD moment and shear capacities of the connected member unless otherwise indicated on the Drawings.
5. No variance design sizes and details shall be permitted on submitted Shop Drawings, but requests for modification of connection type or details to better suit the fabricator's shop practice, or for any other reasons, if submitted in advance of Shop Drawing preparation, will be considered by the Architect and Structural Engineer.
6. Prior to preparation of Shop Drawings, submit plans indicating areas and/or members that are to be fabricated and erected in accordance with the EVSS requirements outlined in this Specification for approval by the Architect and Structural Engineer.

D. Shop Drawing Requirements:

1. Shop Drawings shall include all information required for fabrication of the component parts of the structure. Erection Drawings shall clearly indicate all EVSS members. They shall indicate size, weight, surface preparation, protective coatings, and galvanizing of components, type and location of shop and field connections, and type, size and extent of all welds. Identify grinding, finish, and profile of welds for all EVSS components. 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. Indicate direction of bolt head orientation at connections for all EVSS members.
2. Submit Shop Drawings for EVSS mockups for approval prior to fabrication. Mockups shall be full-size pieces, unless smaller models are approved by the Architect, and shall include a representation of each type of exposed connection or built-up member.
3. 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.

4. 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.
5. 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.

E. 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.

F. 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. Preinstallation Conference: Conduct conference to comply with the requirements of Division 1.

1. Prior to proceeding with structural steel erection, review Contract Document requirements and procedures specified herein for ensuring quality of structural steel work. Representatives of each entity directly concerned with structural steel shall participate, including the following: (1) Architect, (2) Owner, (3) Structural Engineer, (4) General Contractor or Construction Manager, (5) Steel Fabricator and Erector, (6) Owner's Testing Agency. Review items such as: Statement of Special Inspection requirements, Testing Agency procedures, base plate and building perimeter survey, field work/repair procedures, temporary bracing and guying, steel decking and shear connector installation.

B. 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.

C. 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 and moment connections shall be tested one hundred (100) percent either by ultrasonic or by radiography in accordance with the latest edition of the AWS D1.1. However, if, for an individual welder, the reject rate is demonstrated to be five percent or less, the non destructive testing rate may be reduced to 25 percent for the individual welder. The evaluation of the welding shall be based on a sampling of at least 40 completed welds.
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. Anchor rods shall comply with the requirements of ASTM F1554 – Grade 36, except F1554 – Grade 105 as indicated on the Drawings. All anchor rods shall be headed type, with washer. All exterior exposed anchor rods shall be galvanized.

D. Threaded rods shall comply with the requirements of ASTM F1554 - Grade 36.

E. Expansion bolts shall be “Kwik Bolt TZ2” by Hilti, “Strong-Bolt” by Simpson Strong-Tie, “Power-Stud+SD2” by Dewalt, or an approved equal.

F. Hollo-bolts shall be as manufactured by Lindapter, or an equal approved by the Architect.

G. 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.

H. 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.

I. Thermal isolation connections shall include fiberglass-reinforced laminate composite structural plates, washers, and bushings such as “Fabreeka-TIM” by Fabreeka, “Armatherm FRR” by Armatherm, “ClimaSpec TB” by ClimaSpec, or equal approved by the Architect.

J. 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. All Exposed to View Structural Steel (EVSS) shall be fabricated in accordance with the requirements listed below:

1. All exposed welds shall be continuous, unless otherwise noted on the Drawings. Provide uniform weld size and profile.
2. Fabricate EVSS with exposed surfaces smooth, square and of surface quality consistent with the approved mockups.
3. Fabricator shall grind groove, butt and plug welds of EVSS smooth. Welds shall be made flush to the surface of each side and be within +1/16 inch and –0 inch of plate thickness.
4. Form fillets to the smallest radii possible that still comply with the structural requirements. Remove weld spatter and grind where necessary for blending. Contour weld to match those surfaces that are adjacent. Provide additional metallic filler to form smooth continuous surfaces that are to appear as one piece construction when primed. Grind and polish to match profile on approved mockup.
5. All weld show-through shall be minimized by grinding and filling the far side with metallic filler to provide a smooth unblemished surface.
6. Joint gaps between abutting members shall be uniform and minimized to 1/8 inch.
7. Fabricate EVSS members such that piece marks are fully hidden in the final

structure or use appropriate media to permit full removal.

8. Members specified to be rolled to a final curved shape shall be fully shaped in the shop and tied during shipping to prevent stress relieving. Distortion of the web or stem and of outstanding flanges of open sections shall be visibly acceptable to the Architect from a distance of 20 feet under any lighting condition.
9. Seal weld open ends of rectangular hollow structural sections with 3/8 inch minimum closure plates with continuous welds, ground smooth.
10. Remove, grind smooth and fill all tabs, clips, or other fabrication aids.

C. 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.

D. All shop connections shall be welded or bolted.

E. Bolting shall comply with the requirements of RCSC "Specification for Structural Joints Using High-Strength Bolts".

F. All field connections shall be bolted, except where welding is indicated on the Drawings. All field connections for galvanized steel members shall be bolted.

G. Provide thermal isolation connections with plates, washers and bushings, where indicated on the Drawings.

H. Provide weep holes at the bottom of all HSS posts and columns for drainage above the base plate, and as shown on the Drawings.

I. 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.

J. 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.

K. Provide angles, bars, and/or other steel as necessary for deck support at columns where members do not frame in from all four sides and where connections interfere with the support of steel decking.

L. Provide angles, channels, and/or other steel as necessary around all openings in steel roof deck at drains, fans, and other similar penetrations as shown on the Drawings. In addition to the roof openings shown on the Drawings, the Contract shall include an allowance and unit pricing for additional large and small roof openings as noted on the Drawings. Coordinate size, number, and location with Architectural, Mechanical, Electrical, and Plumbing trades.

M. Provide penetrations (round and rectangular) through steel beam webs as shown on the Drawings. Reinforce penetrations as shown on the Drawings. In addition to the penetrations shown on the Drawings, the Contract shall include an allowance and unit price for additional large and small beam web penetrations as noted on the Drawings. Coordinate size, number, and location with Architectural, Mechanical, Electrical, Plumbing and Fire Protection trades.

N. Provide 3/8” (minimum) thickness bent plate where the edge of the slab dimension exceeds the maximum light gauge pour stop overhang dimension noted on the Drawings and where railing systems (by others) will ultimately be attached. Coordinate edge of slab dimensions and railing system locations with the Architectural and Structural Drawings. Shop weld threaded reinforcing bar couplers to bent plates and other structural steel members where indicated on the Drawings.

O. Provide shop welded steel stubs with plates and thermal isolation connections to receive fall arrest/restraint system anchors. In addition to the locations shown on the Structural and Architectural Drawings, the Contract shall include an allowance and unit price for additional stubs as noted on the Drawings. Coordinate locations and details with the Drawings and anchor manufacturer.

P. Vent holes for HSS members to be galvanized shall be located at lower elevations/sides of members and at areas not exposed to view.

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 and structural steel exposed to view in non-public areas, designated as EP on the Drawings, shall be in accordance with “Steel Structures Painting Council Surface Preparation No. 3, Power Tool Cleaning”.

C. Surface preparation for EVSS, exterior steel to be galvanized, and all other exposed exterior structural steel shall be in accordance with “Steel Structures Painting Council Surface Preparation No. 6, Commercial Blast Cleaning”.

D. The surface of the substrate for color galvanized structural steel shall be dry and free from dust, dirt, oil, grease or other contaminants. Coating and cure facility (same as galvanizing facility) shall be maintained free of airborne dust and dirt until coatings are completely cured.

E. Structural steel not exposed to view shall be left unprimed. Structural steel designated as EP shall receive one coat of the manufacturer's standard shop primer.

F. Primer for interior EVSS not scheduled to be fireproofed shall be Tnemec V10-1009 Modified Alkyd Primer (grey color), Sherwin Williams Kem Bond HS Universal Primer B50WZ4 (off-white color), Benjamin Moore Super Spec HP Alkyd Metal Primer P06-70 (grey color), or equivalent approved by the Architect.

G. Primer for EVSS scheduled to be fireproofed with intumescent paint shall be compatible with the intumescent paint manufacturer and approved by the Architect.

H. Where primer is required on steel members, omit the primer at the following locations:

1. Surfaces embedded in concrete.
2. Surfaces to be field-welded.
3. Surfaces at slip-critical connections.
4. The tops of steel beams where deck and/or headed studs are to be welded.
5. Surfaces to be spray fireproofed.

I. Primer shall be applied in accordance with manufacturer’s instruction to provide a minimum dry film thickness of 1.5 mils for steel designated as EP and 3.0 to 3.5 mils for EVSS. Apply primer to ensure no running or sagging. Use priming methods that result in full coverage of joints, corners, edges and exposed surfaces.

J. 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.

K. After erection, all scarred areas shall be touched up with the same paint as the shop coat.

2.04 GALVANIZING

A. All steel items noted on the Drawings to be galvanized shall be galvanized by the hot dip process conforming to ASTM A123 with the addition of nickel to zinc bath. All galvanizing shall be done after fabrication. All galvanized material to be painted shall be primed by the galvanizer within twelve hours after galvanizing and shall be force cured

in a facility capable of maintaining 150 degrees F. All hot dip galvanized steel shall be safeguarded against embrittlement according to ASTM A143.

B. The galvanizer must have a minimum of 10 years of experience in hot dip galvanizing and in the application of the powder coatings for color galvanizing required by this Specification. The galvanizer shall provide a 20 year warranty for finish gloss and color and that galvanized elements shall be free from visible rust over 90% of more of the total exposed area.

C. Structural steel members to be color galvanized shall be hot dip galvanized with a factory-applied polyamide epoxy powder prime coat and fluoropolymer urethane powder topcoat. Color to be coordinated with the Architect. Structural steel shall be immersed in a flux solution and galvanized by the dry kettle process.

D. The galvanizer shall inspect all members for compliance with this Specification, and shall mark each member with a stamp indicating the ASTM number and the weight of the zinc coating in ounces per square foot.

E. Vent holes in HSS members shall be plugged following galvanizing with zinc plugs to match the appearance of the surrounding galvanizing. Vent hole plugs shall prevent moisture entering the HSS members.

PART 3 - EXECUTION

3.01 HANDLING, SHIPPING AND STORAGE

A. Care and protection shall be given to all structural steel, bolts, anchors, 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. Use special care in handling, shipping and storing EVSS after shop priming.

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 Exposed to View Structural Steel (EVSS) shall be erected in accordance with the following requirements:

1. Remove, grind smooth and fill all tabs, clips, or other fabrication aids.
2. Grind all groove, butt and plug welds of EVSS smooth. Welds shall be made flush to the surface on each side and be within +1/16 inch and –0 inch of plate thickness.
3. Form fillets to the smallest radii possible that still comply with the structural requirements. Remove weld spatter and grind where necessary for blending. Contour weld to match those surfaces that are adjacent. Provide additional metallic filler to form smooth continuous surfaces that are to appear as one piece construction when primed. Grind and polish to match profile on approved mockup.
4. All weld show-through shall be minimized by grinding and filling the far side with metallic filler to provide a smooth unblemished surface.
5. Bolt heads shall be oriented uniformly as shown on the approved Shop Drawings.
6. Run-out tabs, angles, erection bolts and other steel members added to connections to allow for alignment, fit-up and welding in the field shall be removed from the structure after permanent field welds or other connections are completed. Remove backer bars, fill all “rat” holes and grind smooth groove welded joints. Fill or plug weld holes for temporary erection bolts and grind smooth. All areas shall be touched up with the appropriate shop primer.
7. Splice members only where shown on the approved Shop Drawings.

C. 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.

D. 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.

E. 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 with the exception of galvanized bolts which shall be A325 heavy hex head. 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.

F. 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.

G. Prior to field welding of any galvanized steel element (if permitted by the Architect), galvanizing in the general area to be welded must be removed by grinding.

H. All galvanized steel elements shall be touched up with a zinc rich paint at areas scarred by welding or bolting in accordance with ASTM A780. For color galvanized structural steel with factory applied coatings, field touch-up shall be applied by a qualified applicator with experience in the application of high-performance industrial coatings. Touch-up shall be performed so that the repair is not visible from a distance of six (6) feet.

I. 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.

J. After erection, all structural steel members and connections shall be touched up with the appropriate primer.

K. Hanger connections and tension rods: stake bolt/rod threads or tack weld nuts following installation.

L. 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.

M. Install fiberglass-reinforced laminate composite isolation plates, bushings, and washers at all thermal isolation connections as shown on the Drawings. Coordinate locations with Architectural Drawings. Install isolation connection components per the manufacturer’s instructions, with bushings and washers located on the “warm” side of the connection.

N. Field weld plate washers to top of brace column base plate after grouting of oversize base plate holes has been completed by 033000, as noted on the Drawings.

3.03 SURVEY

A. Engage the services of a licensed Engineer or Surveyor to survey elevations and locations of all column and arch bases, prior to start of erection of structural steel. Any discrepancies shall be brought to the attention of the Architect. Erection shall not

proceed until any required remedial measures have been completed.

B. Upon completion of the building frame provide a survey of perimeter building columns that indicates the plan deviation (as applicable) from the column grid in each direction at each level.

3.04 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 ¾ inch from its theoretical plan location.
2. Members at connections to columns shall be within 1/8 inch vertically of their theoretical elevations.
3. Tolerances for Exposed to View Structural Steel (EVSS) shall not exceed one-half of those permitted for structural steel.

END OF SECTION 05 12 00

SECTION 051226

SHEAR CONNECTORS

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 installing all shear connectors as shown on the Drawings and as specified herein and includes, but is not limited to the following:

1. Headed shear connectors.

1.03 RELATED SECTIONS

A. Related work shall be performed under the following Sections:

1. Section 033000 CAST-IN-PLACE CONCRETE
2. Section 051200 STRUCTURAL STEEL FRAMING.
3. Section 053000 STEEL DECKING.

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 360 "Specification for Structural Steel Buildings".
2. American Welding Society (AWS): AWS D1.1 "Structural Welding Code - Steel".
3. American Society for Testing and Materials (ASTM): standards listed within.

B. In case of conflict between the References and the Project Specification, or in case of conflict between References, the more stringent shall govern.

C. When compliance with such References is specified 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 in accordance with the provisions of Section 01 30 00 – SUBMITTAL PROCEDURES.

B. Shop Drawings shall indicate size, position, spacing, and fastening methods of all shear connectors.

C. Approval of Shop Drawings will be for size and arrangement of shear connectors. Errors in dimensions shown on the Shop Drawings shall be the responsibility of the Contractor.

D. Purchasing of any materials or performing any work prior to the final approval of Shop Drawings will be entirely at the risk of the Contractor.

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 011401 – ELECTRONIC RELEASE FORM. Reproduction of structural plans, sections and details, and any like information by reprographic or electronic methods for us 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. A qualified Testing Agency for testing and inspection shall be selected by the Owner and shall be paid directly by the Owner.

B. All materials and workmanship under this Section will be subject to inspection in the mill, shop or field by the Architect and/or the Owner’s Testing Agency.

C. However, such inspection, wherever conducted, shall not relieve the 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 it by the Owner or Architect if defects are discovered.

D. A minimum of two shear connector studs shall be welded at the start of each production period to determine proper settings for the generator, control unit, and stud welder. These studs shall be capable of being bent 45 degrees from vertical without weld failure. If, after welding, visual inspection reveals that a sound, full 360 degree weld has not been achieved for any particular stud, that stud will be struck with a hammer and bent approximately 15 degrees from vertical towards the nearest end of the beam, or bent away from the opening in the fillet weld. Studs meeting this test will be considered acceptable and shall be left in this position. Studs failing under this test shall be replaced.

E. The Contractor shall give proper notice to inspection agencies designated by the Architect and shall allow access and full facilities as required for this inspection. Make all necessary accommodations and provide access as required for the Testing Agency to conduct the testing and inspection work required by the Statement of Special Inspections.

F. A final letter will be issued by the Testing Agency following the completion of work in this Section stating that all testing and inspections for shear connector work required by the Statement of Special Inspections have been completed and all identified deficiencies have been corrected.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All shear connectors shall be Type B headed studs, per AWS D1.1, and made from cold drawn bar stock conforming to the requirements of ASTM A 108, Grades 1010 through 1020, either semi- or fully- killed. Refer to the Drawings for lengths and diameter.

B. Tensile requirements of shear connector studs, as determined by tests (ASTM A 370) of bar stock after drawing, or of full diameter finished studs, at the manufacturer's option, shall conform to the following:

1. Tensile strength, (psi) minimum: 65,000
2. Elongation in two inches, (%) minimum: 20
3. Reduction in area, (%) minimum: 50

C. Shear connectors shall be of uniform diameter; heads shall be concentric and normal to shaft; and the weld shall be chamfered and solid fluxed.

D. Shear connectors shall not be painted or galvanized.

PART 3 - EXECUTION

3.01 STORAGE

A. Care and protection shall be given to all shear connectors during handling and storage. If connectors are to be stored prior to installation, they shall not be placed in contact with the ground and shall be protected from the elements and kept dry.

3.02 INSTALLATION

A. Shear connectors shall be installed by an automatic welding system, in the number and spacing shown on approved Shop Drawings and as herein specified. Install a minimum of one shear connector per foot of beam length on all beams supporting concrete slabs on composite steel deck.

B. Steel in the area to which the shear connector is to be directly welded should be free of loose mill scale, heavy rust, dirt and paint. In addition, where studs are to be welded through metal deck, verify that no water has become entrapped between the beam and the deck, prior to welding shear connectors.

C. Shear connectors should not be welded when the temperature falls below 10 degrees Fahrenheit, or when the surface is wet with rain or snow.

D. All welding shall be in accordance with AWS D1.1.

E. After welding, break off ceramic arc shields and dispose of them properly.

END OF SECTION 05 12 26

SECTION 053100

STEEL DECKING

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 installing all metal deck work as shown on the Drawings and as specified herein and includes, but is not limited to, the following:

1. Steel roof deck.
2. Composite steel floor deck.
3. Roof deck accessories: finish strips, butt strips, ridge plates, valley plates, splice plates, sump pans and rubber closures.
4. Floor deck accessories: finish strips, butt strips, closures and pour stops.
5. Shop coating and field touch-up paint after erection.

1.03 RELATED SECTIONS

A. Related work shall be performed under the following Sections:

1. Section 033000 CAST-IN-PLACE CONCRETE.
2. Section 051200 STRUCTURAL STEEL FRAMING.
3. Section 051226 SHEAR CONNECTORS.
4. Section 054000 COLD-FORMED METAL FRAMING.
5. Section 078100 APPLIED FIREPROOFING.

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. Steel Deck Institute (SDI): "Code of Standard Practice for Steel Deck”.
2. American Society for Testing and Materials (ASTM): standards listed within.
3. American Welding Society (AWS): AWS D1.3 "Structural Welding Code - Sheet Steel".

B. In case of conflict between the References and the Project Specification, or in case of conflict between References, the more stringent shall govern.

C. When compliance with such References is specified 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 in accordance with the provisions of Section 01 30 00 – SUBMITTAL PROCEDURES.

B. Shop Drawings shall indicate size and location of framing supports and the location, lengths, types, gauges, and markings of deck units. Shop Drawings shall indicate fastening methods for deck units, and the type of connections, welds or screws, and other items as hereinafter called for.

C. Shop Drawings shall also show all accessories and methods of attachment to the building frame.

D. Approval of Shop Drawings shall be for size and arrangement of units and for general conformance with the requirements of the Contract Documents. Any errors in 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 shall be responsible for compliance with the Contract Documents. Review of the Shop Drawings by the Architect shall not relieve the Contractor of this responsibility.

E. Fabrication of any material or performing any work prior to the final approval of the Shop Drawings will be entirely at the risk of the Contractor.

F. 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 us 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. Testing and Inspections: All materials and workmanship under this Section shall be subject to inspection in the mill, shop or field by the Architect, 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 the 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. All deck fastening shall be visually inspected.
5. A final letter shall be issued by the Testing Agency following the completion of the work in this Section stating that testing and inspections for steel decking required by the Statement of Special Inspections have been completed and all deficiencies have been corrected.

1.07 SUBSTITUTIONS

A. Substitutions or modifications to details or materials proposed by Contractor shall 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), 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 STEEL ROOF DECK

A. Typical steel roof deck shall be formed of steel sheets conforming to ASTM A653 Grade 50, with a minimum yield strength of 50,000 psi with nestable side lap. All steel roof deck shall have a maximum nominal top-side gap between flutes of 2¾ inch. Galvanized coating shall conform to ASTM A653 G60. Refer to Drawings for deck type, gauge and depth.

B. Typical steel roof deck units shall be cut to required lengths so that end joints will occur over supporting members and be lapped a minimum of two inches. Typical lengths shall extend over three or more spans, where possible.

2.02 COMPOSITE STEEL FLOOR DECK

A. Typical steel floor deck shall be formed of steel sheets conforming to ASTM A653 minimum Grade 50, with a minimum yield strength of 50,000 psi. All steel floor deck shall be composite type with six inch wide (nominal) flutes top and bottom sides at 12 inch on center and interlocking side laps. Galvanized coating shall conform to ASTM A653 G60. Refer to the Drawings for gauge and depth. Metal floor deck units shall be cut so that end joints will butt over supporting members. Typical lengths shall extend over three or more spans where possible.

B. Steel floor deck units shall be cut so that end joints will butt over supporting members. Typical lengths shall extend over three or more spans where possible.

2.03 STEEL DECK ACCESSORIES

A. Accessory steel sections shall be of the same material, gauge and finish as the steel deck units, unless otherwise indicated.

B. Pour stops shall be not lighter than 18 gauge and be of the same material and finish as the steel deck units. Use heavier gage as indicated on the Drawings.

C. Sump pans shall be recessed and not lighter than 14 gauge galvanized sheets. Size of

the hole to be field cut to match the roof drain.

2.04 PROTECTIVE COATINGS

A. Steel deck units shall be cleaned of scale, rust, grease, oil or other foreign matter.

B. Steel deck surfaces to remain exposed to view shall be shop coated with an approved primer (white color) and oven baked. The primer shall be verified by the field painting contractor for compatibility with approved field top coat paints under Section 099000 PAINTING AND COATING.

PART 3 - EXECUTION

3.01 HANDLING, SHIPPING AND STORAGE

A. Care and protection shall be given to all metal decking material during handling and storage. During unloading and hoisting, extra care shall be given to prevent damage to the ends, sides and distortion of the individual items. If items are to be stored prior to installation, they shall not be placed in contact with the ground and should be stored with a sloping ventilated, waterproof covering.

3.02 INSTALLATION

A. Steel deck shall be erected and fastened in accordance with manufacturer's specifications, approved Shop Drawings, and as hereinafter specified.

B. Place steel deck units on supporting framework and adjust to final position with proper bearings, end and side laps before permanently securing work.

C. Welds to steel supports shall be fusion type. Puddle welds shall be at least 5/8 inch diameter or an elongated weld having an equal perimeter.

D. Typical steel roof deck units shall be fastened to the supporting structure (minimum requirements) as follows:

1. Panel ends and end laps: Welded at each rib.
2. Intermediate supports: Welded at each rib.
3. Longitudinal edges at marginal supports: Welded maximum spacing of 12 inches.
4. Nested side laps of adjacent units: Screw fastened between supports at intervals not exceeding 24 inches.

E. Typical composite steel floor deck units shall be fastened to the supporting structure (minimum requirements) as follows:

1. Panel ends and end laps: Welded at each rib.
2. Intermediate supports: Welded at each rib.
3. Longitudinal edges at marginal supports: Welded, maximum spacing of 12 inches.
4. Interlocking side laps of adjacent units: Button punched between supports at intervals not exceeding 30 inches.

F. Install ridge and hip plates, flat plates, finish strips, closures, splice plates, and pour stops according to deck manufacturer's written instructions. Install continuous flat plate on steel roof deck at all rising wall conditions to create a level bearing surface for stud wall bottom tracks. Weld or mechanically fasten accessories to substrate to provide a complete deck installation.

G. Provide field fabricated sheet closures at all perimeter and interior columns, breaks at perimeter pour stops, and at all similar locations as required for a complete job.

H. Fasteners for overlying roofing material shall be concealed within the depth of the roof deck ribs.

I. Holes and openings that are indicated on the Drawings shall be cut by the deck erector. Coordinate locations with respective trades. Holes not so indicated, but which are

required for work by other trades, shall be located and cut by the respective trades pending prior approval by the Architect.

J. All welding shall be in accordance with the References and shall be done only by experienced welders who have previously been qualified to perform the type of work

K. After erection, all scarred areas of roof decking, including cuts, drill holes, rust spots, welds and weld scars, shall be touched up with a zinc-rich paint.

L. No architectural, mechanical, electrical, plumbing, fire protection or other components shall be hung from steel roof deck.

END OF SECTION 05 31 00

SECTION 05 40 00
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formed steel stud exterior wall framing.

B. Exterior wall sheathing.

1.02 RELATED REQUIREMENTS

A. Section 01 45 33 – Code-Required Special Inspections and Procedures.

B. Section 01 45 33.1 – Statement of Special Inspections: Special inspector scope for this section.

C. Section 04 20 00 - Unit Masonry: Veneer masonry supported by CFMF stud wall.

D. Section 05 12 00 - Structural Steel Framing.

E. Section 06 10 54 - Wood Blocking and Curbing: Wood blocking for window and curtainwall support.

F. Section 07 21 00 - Thermal Insulation: Cavity wall insulation and cladding support system.

G. Section 07 25 00 - Weather Barriers: Water-resistive barrier over sheathing.

H. Section 07 42 64 – Metal Composite Material Wall Panels: Cladding support system and minimum CFMF requirements for load support of wall panel and associated cladding support systems.

I. Section 07 53 00 - Elastomeric Membrane Roofing: Deck board for use on vertical parapet surfaces to be covered by roofing membrane flashing.

J. Section 07 90 05 - Joint Sealants.

K. Section 09 21 16 - Gypsum Board Assemblies: Interior metal stud partitions, soffit and ceiling framing.

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

1.03 DEFINITIONS

A. General: See AISI S240 for definitions of terms used in this section.

B. Connection: A combination of structural elements and joints used to transmit forces between two or more members.

C. Connector: A device used to transmit forces between cold-formed steel structural members or between a cold-formed steel structural member and another structural element.

1.04 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).

B. AISI S201 - North American Standard for Cold-Formed Steel Framing - Product Data; 2017.

C. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).

D. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

F. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

G. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.

H. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020.

I. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.

J. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

K. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.05 REGULATORY REQUIREMENTS

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

1.06 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with work of other sections that is to be installed in or adjacent to metal framing systems, including but not limited to structural anchors, cladding anchors, cladding support system, utilities, insulation, and firestopping.

B. Preinstallation Meeting: Conduct a preinstallation meeting at least two weeks prior to the start of the work of this section; require attendance by affected installers.
   1. Discuss timing of Special Inspector site inspections.

1.07 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's data on factory-made connectors, mechanical fasteners, and material descriptions, base steel thickness, corrosion protection, showing compliance with 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. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
   1. Indicate stud and ceiling joist layout.
   2. Describe method for securing studs to tracks and for bolted framing connections.
   3. Provide engineer's stamp on drawings.
   4. Provide details and supporting calculations for support of wood-based cantilevered window blocking, including verification of window sill track thickness/gauge, fastener design for attachment of window sill track and other CFMF members forming rough opening to other CFMF members, and fastener design of attachment of wood blocking (provided in section 06 10 54) to window sill track and other CFMF members forming rough openings.
      a. Provide window gravity loads to design engineer for calculation purposes.
   5. Provide calculations for loadings and stresses of all framing that bear the seal of the licensed structural engineer employed by the CFMF subcontractor, licensed in the State where the Project is being constructed.
      a. Submit record copy of loads and reactions provided under Section 07 42 64 for wall panel and associated cladding support systems with this submission. The purpose of submission is to verify CFMF coordination for support of such loads has been provided.

E. Manufacturer's Installation Instructions: Provide installation instructions for connectors.

F. Designer's Qualification Statement.

G. Samples: Upon request, submit samples of materials specified herein.

1.08 QUALITY ASSURANCE

A. Designer Qualifications: Design framing system under direct supervision of a professional structural engineer experienced in designing this work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum fifteen years of documented experience.
   1. Member in good standing of the Steel Framing Industry Association. Products shall be certified under an independent third party inspection program administered by an agency accredited by IAS to ICC-ES AC98 IAS Accreditation Criteria for Inspection Agencies.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

1.09 MOCK-UPS

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

B. Provide metal stud framing for exterior wall mock-up(s) specified in Section 04 20 00 - Unit Masonry, Section 07 42 64 – Metal Composite Material Wall Panels .
   1. Mock-up panel(s) shall demonstrate actual wall construction, detailing and workmanship.
   2. No work shall progress until the Architect has reviewed the mock-up panel(s). Panel(s) shall be revised as necessary to secure the Architect’s acceptance and shall then become the standard of comparison for all related exterior wall work.
   3. Mock-up panel(s) shall not be destroyed or moved until the Work is complete and accepted by the Architect. Upon completion of construction, mock-up panel(s) shall be removed.

1.10 DELIVERY, STORAGE AND HANDLING

A. Protect and store metal framing units from rusting and damage in accordance with AISI Code of Standard Practice. Deliver to project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type, and grade. Store off ground in a dry ventilated space or protect with suitable waterproof covering.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Structural Metal Framing:
   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.

B. Connectors:
   1. Same manufacturer as metal framing.

2.02 PERFORMANCE REQUIREMENTS

A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

B. Design Requirements: Design cold-formed framing systems, components and connectors to withstand specified design loads in compliance with ICC (IBC), ASCE 7, AISI S100, and AISI S240.

C. Design Criteria: Provide completed framing system having the following characteristics: .
   1. Design: Calculate structural characteristics of cold-formed steel framing members according to AISI S-100 North American Specification for the Design of Cold-Formed Steel Structural Members.

2. Structural Performance: Design, engineer, fabricate, and erect to withstand specified design loads for project conditions within required limits.
3. Design Loads: Wind and seismic loads as indicated on the Structural Drawings, but not less than required by Code.
4. Live load deflection meeting the following, unless otherwise indicated:
   a. Horizontal Deflection: Design to permit maximum deflection of L/720 of span of framing supporting masonry veneer exterior walls.
   b. Horizontal Deflection: Design to permit maximum deflection of L/360 of span for composite and MCM siding finish.
   c. Vertical Deflection: Design framing to accommodate deflection of the structural steel framing members.
5. Provide industry standard safety factors as suited to specific job conditions.
6. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges of 120 deg F.
7. Able to accommodate construction tolerances, deflection of building structural members from dead, live, and superimposed dead loads, and clearances of intended openings. Anticipated maximum roof structure deflection is 3/4". Deflection joint size for joints with sealant or firestop sealant shall accommodate the 50% movement ability of the sealant, thereby setting the deflection gap at 1-1/2" at roof framing.
8. Coordinate all framing with the required spray applied fire proofing of structural steel.
9. Floor Live Loads:
   a. Minimum Uniformly Distributed: 50 psf.
   b. Minimum Concentrated: 2,000 lbs.
10. Able to provide support for all window, storefront, curtainwall, and door frame systems housed within the framing. See drawings for project specific details
11. Provide fastener schedules / anchorage details for all blocking and other systems supporting by the framing.

2.03 MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.

2.04 STRUCTURAL FRAMING COMPONENTS

A. Wall Studs and Track Sections: AISI S240; c-shaped or "sigma" shape studs and u-shaped track sections in stud-matching nominal width and compatible height.
   1. Structural Grade: As required to meet design criteria.
   2. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240, except for location listed below:
   3. Thickness and Depth: Depth as indicated on the drawings; thickness and structural grade as required to meet design criteria, but in no case less than 43 mils (0.043 inch) thickness.
   4. To the extent that component types and thicknesses 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 fabricator's engineer. Framing member depths indicated on the Drawings shall not be altered without the Architect's prior written authorization.
   5. Stud spacing shall not exceed 16 inches on center.

B. Joists: AISI S240; manufactured, engineered open-web steel joists.
   1. Thickness and Depth: Depth, thickness and structural grade as required to meet specified design criteria.
   2. Joist spacing as indicated on drawings.

2.05 CONNECTIONS

A. Performance Requirements: Provide connections in compliance with requirements of AISI S240.

B. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.
   1. Structural Grade: As required to meet design criteria, not less than ST33H.
   2. Corrosion Protection Coating Designation: CP 90 in accordance with AISI S240.

C. Structural Performance: Maintain load and movement capacity required by applicable building code and specified design criteria.

D. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, shouldered screws or screws and anti-friction or stepped bushings, while maintaining structural performance of framing. Provide movement connections where indicated on drawings.
   1. Where continuous studs bypass elevated floor slab, connect stud to slab in manner allowing vertical and horizontal movement of slab without affecting studs:
      a. Allow for minimum vertical movement of 1/360 of span of steel framing at slab level or 3/4 inch, whichever is greater.
      b. Allow for minimum horizontal movement of 1/240 of the wall height under a horizontal load of 5 psf.
   2. Where top of stud wall terminates below structural floor or roof, connect studs to structure in manner allowing vertical and horizontal movement of slab without affecting studs:
      a. Allow for minimum vertical movement of 1/360 of span of steel framing above or 3/4 inch, whichever is greater.
      b. Allow for minimum horizontal movement of 1/240 of the wall height under a horizontal load of 5psf.
   3. Provide top track with long leg track and head of wall movement connectors; minimum track length of 10 feet.

E. Fixed Connections: Provide nonmovement devices for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.

F. Channel Bridging and Bracing: U-channel; minimum 0.0538" thickness; minimum 0.5" wide flanges; depth as indicated or required.

2.06 MISCELLANEOUS CONNECTIONS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot-dip galvanized per ASTM A153/A153M. Size, type, penetration and spacing shall be in strict accordance with the CFMF contractor's engineered design requirements.
   1. Coating: Corrosion resistant, high-performance polymer complying with ASTM B117; salt spray test result of no rust or other base metal corrosion after a minimum of 800 hours.

B. Anchorage Devices: Powder actuated.

C. Welding: Not Permitted.

2.07 SHEATHING

A. Glass-mat-faced gypsum board; ASTM C1177/C1177M, square long edges, 5/8 inch thick, Type X - fire-resistant.
   1. Products:
      a. Georgia-Pacific; DensGlass Gold.
      b. USG; Securock Glass-Mat Sheathing.
      c. Certainteed; GlasRoc Sheathing.
      d. National Gypsum; Gold Bond eXP Sheathing.
      e. Substitutions: See Section 01 60 00 - Product Requirements.

2.08 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

B. Plates, Gussets, Clips: Formed Sheet Steel, thickness determined for conditions encountered; finish to match framing components.

C. Clips (For securing cold formed metal framing members to structural steel components intended to receive sprayed-on fireproofing): Finish to match framing components, depth as required for thicknesses of fireproofing, size and thickness as determined by CFMF system engineering.

D. Galvanizing Repair: Touch up bare steel with zinc-rich paint in compliance with ASTM A780/A780M.

E. Sill Gaskets: Continuous 1/4" thickness closed cell foam from continuous rolls, for use under CFMF tracks on concrete at building perimeters.

F. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify field measurements and adjust installation as required.

3.02 PREPARATION

A. Structural Wall Foundations: For gaps between wall bottom track and top of foundation 1/4 inch or greater, level substrate with loadbearing shims or grout between track and foundation.

B. Coordination with sprayed-on fireproofing: Attach offset clips to structural steel surfaces according to engineered shop drawings prior to installation of cold-formed metal framing members.

1. Do not conceal conditions by other construction prior to required inspection of sprayed-on fireproofing.

3.03 INSTALLATION - GENERAL

A. Install structural members and connections in compliance with ASTM C1007.

3.04 INSTALLATION OF STUDS

A. Install sill gaskets continuously on perimeter concrete surfaces and where indicated on Drawings, prior to track installation.

B. Install continuous tracks sized to match studs. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 24 inches on center. Provide fasteners at corners and ends of tracks. Coordinate installation of sealant with floor and ceiling tracks.

C. Place studs plumb, at 16 inches on center; not more than 2 inches from abutting walls and at each side of openings. Connect studs to tracks using fastener method.

D. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.

E. Abutting Structure: Where stud system abuts structural column or walls, including masonry walls, anchor ends of stiffeners to supporting structure.

F. Install load-bearing studs full length in one piece. Splicing of studs is not permitted.

G. Install load-bearing studs; brace, and reinforce to develop full strength and achieve design requirements.

H. Wall Openings: Frame wall opening larger than 2 feet square with additional studs (2 minimum) at each jamb of frame as required by the engineered design. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with stud shoes and space jack studs same as full-height studs of wall.

I. Install intermediate studs above and below openings to align with wall stud spacing.

J. Secure studs to top (except as noted below for deflection tracks) and bottom runner tracks by screw fastening at both flanges. Provide deflection head track directly below horizontal building

framing at non-load bearing framing. Use slotted deflection tracks (with screws installed near bottom of slot) or remove screws from non-slotted track once all bridging and exterior sheathing is in place.

K. Supplementary 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, comply with stud manufacturer's recommendations, engineering and industry standards in each case, considering weight or loading requirements resulting from item supported.

L. Attach cross studs to studs for attachment of fixtures anchored to walls.

M. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

N. Touch-up damaged corrosion-protected surfaces zinc-rich paint in compliance with ASTM A780/A780M.

3.05 INSTALLATION OF JOISTS

A. Install framing components in accordance with manufacturer's instructions.

B. Install framing components in accordance with fire damper manufacturer’s requirements and the UL fire rated assemblies referenced on the Drawings.

C. Make provisions for erection stresses. Provide temporary alignment and bracing.

D. Place joists at 16 inches on center; not more than 2 inches from abutting walls, and connect joists to supports using fastener method.

E. Set floor and ceiling joists parallel and level, with lateral bracing and bridging.

F. Provide web stiffeners at reaction points.

G. Touch-up field welds and damaged galvanized surfaces with primer.

3.06 INSTALLATION OF WALL SHEATHING

A. General: Inspect materials to which gypsum sheathing is to be applied. Remedy all defects prior to installation of sheathing. Provide additional studs and bracing if required to secure sheathing at outside corners or board joints.

B. Install wall sheathing with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using self-tapping screws. Cut by scoring or sawing. Gypsum sheathing shall be fitted tightly to abutting sheathing. All joints shall be closed tight.

1. Coordinate sheathing installation with requirements of the air barrier system. If gaps in sheathing exceed requirements of Section 07 25 00 - Weather Barriers, they shall be taped with product recommended by Weather Barrier manufacturer.

C. Sheathing shall be held in firm contact with substrate while fasteners are being driven. Sheathing shall be fastened as determined and detailed by the engineered design. Unless otherwise indicated, space fasteners a maximum of 8 inches o.c. around perimeter and in field at framing locations. Care shall be taken not to break sheathing face while driving fasteners.

D. Fastening Sheathing: Gypsum board at exterior walls may be an integral part of the structural lateral stud bracing of the masonry veneer. Coordinate with the requirements of the engineered design.

3.07 FIELD QUALITY CONTROL

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

B. Testing and inspection shall be performed by the Owner's Testing Agency and/or Special Inspector as identified in the Statement of Special Inspections. Frequency of inspection shall be performed as identified in the Statement of Special Inspections.

C. If work is found not to conform to the Construction Documents, the Contractor shall be responsible for the cost of all further testing and repair or replacement measures.

3.08 TOLERANCES

A. Studs - Vertical Alignment (Plumbness): 1/960 of span or 1/8 inch in 10 ft, in accordance with ASTM C1007.

B. Studs - Maximum Variation from True Position: 1/8 inch in accordance with ASTM C1007.

C. Stud Spacing: 1/8 inch from the designated spacing, provided that the cumulative error does not exceed the requirements of the finishing materials in accordance with ASTM C1007.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated miscellaneous steel and aluminum items. including but not limited to:
   1. Frames, brackets and supports for:
      a. Part-height partition braces (shop-fabricated or manufactured).
      b. Supports for other equipment as indicated.
   2. Bollards.
   3. Roof edge blocking supports.

B. It shall be a requirement of the Work of the Section to thoroughly review all of the Contract Documents and provide any and all miscellaneous metal fabrications required for a complete and proper job.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

B. Section 04 20 00 - Unit Masonry: Placement of metal fabrications in masonry.

C. Section 05 12 00 - Structural Steel.

D. Section 06 10 54 – Wood Blocking and Curbing.

E. Section 09 91 13 - Exterior Painting: Paint finish.

F. Section 09 91 23 - Interior Painting: Paint finish.

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

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

D. ASTM A276/A276M – Standard Specification for Stainless Steel Bars and Shapes; 2025.

E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.

F. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.

G. 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.

H. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.

I. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2023).

J. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172 2019.

K. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.

L. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.

M. SSPC-SP 2 - Hand Tool Cleaning 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. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit for manufactured products specified herein.

C. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Submit lintel fabrication schedule including location, type, size, length and finish (primed or galvanized coating class).
   2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
   3. Design data: Submit drawings and supporting calculations, signed and sealed by a qualified professional structural engineer.
      a. Include the following, as applicable:
         1) Design criteria.
         2) Engineering analysis depicting stresses and deflections.
         3) Member sizes and gages.
         4) Details of connections.
         5) Support reactions.
         6) Bracing requirements.
   4. Submit slotted channel framing system structural calculations including, but not limited to design criteria, stress and deflection analysis and selected framing, fittings and anchors prepared by a registered professional structural engineer in the State in which the Project is located.

D. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.

E. Certifications:
   1. Submit seismic analysis certification sealed and signed by a registered professional structural engineer in the State in which the Project is located, that all equpment stands, frames, and supports comply with applicable codes.
   2. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.
   3. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.
   4. Submit documentation of steel fabricator's in-plant special inspections program including registration of special inspections program, written procedural and quality control manuals and evidence of periodic auditing of fabrication practices by an approved inspection agency.

1.06 QUALITY ASSURANCE

A. Fabricator's Qualifications: Only fabricators that maintain an agreement with an approved independent inspection or quality control agency to conduct periodic in-plant inspections at the fabricator's plant, at a frequency that will assure the fabricator's conformance to the requirements of the inspection agency's approved quality control program will be approved for this project.

B. Design metal fabrications under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

C. Welding Standards: Comply with applicable provisions of ASW D1.1 "Structural Welding Code - Steel" and ASW D1.3 "Structural Welding Code - Sheet Steel".

1.07 PRODUCT HANDLING

A. Delivery of Materials: Deliver, store and handle components in such a manner as to prevent damage to finished surfaces.

B. Storage of Materials: Store components in a dry, clean location, away from uncured masonry and concrete. Cover with tarpaulin or polyethylene sheeting.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A 53/A 53M Grade B Schedule 40, black finish.

E. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.

F. Slotted Channel Framing: ASTM A653 Grade 33, electro-galvanized steel metal channel framing and ASTM A1011 channel fittings system
   1. Engineered, fabricated and installed by the manufacturer's authorized installer with a minimum of five (5) years of experience.
   2. Manufacturer: Unistrut Corp.
      a. Substitutions: See Section 01 60 00 - Product Requirements.

G. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.
   1. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, galvanized to ASTM A153/A153M where connecting galvanized components, stainless steel for connecting stainless steel components.
   2. Machine Screws: ANSI B18.6.3.
   3. Lag Bolts: ANSI B18.2.1.
   4. Expansion Anchors: Carbon steel components zinc-plated to comply with ASTM B633.

H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

I. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

J. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Metal fabrications shall be standard approved products, fabricated in accordance with best shop practices and, wherever possible, shop assembled, ready for erection.

B. Metals shall be free from defects impairing strength, durability, or appearance and shall be best commercial quality for purposes specified. Metals shall be made with structural properties, to safely sustain and withstand strains, stresses, to which they will be normally subjected.

C. Fit and shop assemble items in largest practical sections, for delivery to site.

D. Fabricate items with joints tightly fitted and secured.

E. Continuously seal joined members by continuous welds.

F. 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.

G. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

H. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

A. Miscellaneous Framing and Supports: Provide steel framing and supports for applications indicated that are not a part of structural steel scope as required to complete the Work. Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent construction. Fabricate from steel shapes, plates, and steel bars of welded construction using mitered joints for field connections. Cut, drill, and tap units to receive hardware, hangers, and similar items. Equip units with integrally welded anchors for casting into concrete or building into masonry.
   1. Counter supports: Support frame and post assembly shall be completely concealed within the counter assembly and adjacent wall partitions. Framing system shall support 100 lbs per linear foot of counter length for 24 inch deep counters. Coordinate with counter assembly configuration as indicated on the Drawings.
   2. Partial-Height Stud Partition Posts: Support frame and post assembly shall be completely concealed within the wall partition. Posts shall be fabricated for attachment of adjacent metal studs, with welded baseplates and holes for expansion bolting to concrete floor slabs. Partition heights shall be as indicated on the Drawings. Framing shall support all partition loads as indicated in Section 09 21 16 - Gypsum Board Assemblies.
      a. Product:
         1) ClarkDietrich Building Systems LLC; Pony Wall.
         2) Substitutions: See Section 01 60 00 - Product Requirements.

B. Shelf Angles Not Attached to Structural Framing: For support of masonry; hot-dipped galvanized finish.

C. Loose Lintels: As detailed; hot-dipped galvanized finish.
   1. Refer to Lintel Schedule on Structural Drawings for sizing.
   2. Loose lintels shall be fabricated from A-36 steel from angles, shapes and masonry anchors of size and type scheduled for openings in masonry walls, unless otherwise indicated on the Drawings.
   3. Provide not less than eight (8") inches bearing at each side of openings, unless otherwise indicated. Under no circumstances shall bearing (each end) be less than one (1") inch per foot of span.
   4. Loose lintels, unless specifically otherwise noted, shall be installed with long legs vertical.
   5. All exterior wall lintels shall be hot-dipped galvanized after fabrication. Back-to-back lintels shall have exposed seams continuously welded and ground smooth prior to galvanizing.
   6. Lintels shall be required over all openings in masonry walls, including openings required for all other trades (i.e. mechanical and electrical equipment and ductwork, etc).

D. Stainless Steel Angle, Threshold Support, ASTM 276, type 316.

E. Slotted Channel Framing System: For concealed overhead support of ceiling mounted fixtures; engineered, fabricated and installed by the manufacturer's authorized installer.
   1. Field inspection to verify job conditions, dimensions, and suitability of primary structure to receive channel framing.
   2. Engineering of all channel framing, attachments between framing members, attachments between framing systems and building structure, and anchor points to receive attachments by the manufacturer of the building material or equivalent to be supported by the channel framing systems.
   3. Coordination of framing load capacity and anchor point types and locations with the requirements of the related material or equipment manufacturer.

F. Roof Perimeter Blocking Fastening Requirements:

1. Perimeter roof blocking shall be secured to decking, structural steel, spaced steel angles, or plates, as indicated on the Drawings.
2. The Contractor shall provide additional steel angles and plates to suit specific job conditions.
3. Where joist or beams do not extend out to roof edge, provide single or back to back steel angles or steel plates welded to perimeter steel beams in configurations indicated on the Drawings or otherwise required for support of blocking at 2'-0" o.c. intervals. Provide pre-drilled holes in steel for bolting of blocking at 24" o.c. with 1/2" bolts.

2.04 FINISHES - STEEL

A. Shop Priming: Shop prime all steel items, unless otherwise indicated.
   1. Exception: Galvanized items to be embedded in concrete and items to be imbedded in masonry.
   2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
   3. Preparation:
      a. Prepare exterior steel surfaces to be primed in accordance with SS PC-SP6 Commercial Blast Cleaning Standard.
      b. Prepare interior steel to be primed and steel to be fireproofed in accordance with SS PC-SP3 Power Tool Cleaning Standard.
      c. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
   4. Product: One coat shop standard primer, 2 - 3 mils DFT.

B. Galvanizing: Galvanize steel members after fabrication to ASTM A123 requirements by a member of the American Galvanizers Association, Inc with a high grade, non-lead zinc bath.
   1. Smoothness: galvanizing shall a rugosity of 4 or less (16-20 microns of variation) when measured by a profilometer over a 1 inch straight line on the surface of elemetns that are less than 24 pounds per running foot. Profilometer shall be capale of operating in 1 micron increments.
   2. All hot-dipped galvanized material shall be stamped to indicate ASTM designation and ounces per square foot of zinc coating required by the specifications.
   3. Warranty: Galvanizer's standard warranty that materials shall be free from 10% or more visible rust for 20 years.
   4. Where hot-dip galvanizing prior to completion of fabrication (cutting or welding operations) cannot be avoided, joints and cuts shall be finished with four (4) full coats of touch-up galvanizing repair paint as recommended by the fabricator.

C. Bituminuous Paint: Cold-applied mastic complying with SSPC-Paint 12 except containing no asbestos fibers.

D. Galvanizing Repair Paint: High zinc content paint, Tnemec 90-97.

2.05 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work. Coordinate all work with the work of other trades.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Furnish setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

C. Shearing and punching shall leave clean true lines and surfaces. Weld or rivet permanent connections. Welds and flush rivets shall be finished flush and smooth on surfaces that will be exposed after installation. Welds shall be continuous unless otherwise noted. Welds shall not have voids or pockets and shall be ground to provide smooth transitions between metal surfaces. Do not use screws or bolts where they can be avoided; where used, heads shall be countersunk, screwed up tight and threads nicked to prevent loosening.

D. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall give ample strength and stiffness. Joints exposed to weather shall be formed to exclude water. Provide holes and connections for the work of other trades.

E. Connections and accessories shall be adequate to safely sustain, withstand stresses, strains, to which they will be normally subjected.
   1. Connections to steel unless otherwise specified shall be steel.
   2. Connections to genuine wrought iron work shall be wrought iron or steel.
   3. Connections to cast iron, unless otherwise specified shall be steel.
   4. Bolts, nuts, screws for exterior work shall be electrogalvanized, unless otherwise noted.

F. Furnish all standard screws, bolts, washers, and other such fastening devices as are necessary for attaching this work to other materials. Anchors and other connecting devices required in concrete or masonry shall be built-in as the work progresses. NOTE: Special attention shall be given to the firm and secure anchoring of overhead mounted materials and equipment.

G. Do cutting, punching, drilling, tapping required for attachment of other work coming in contact with miscellaneous metal where so indicated or where directions for same are given prior to or with review of shop drawings.

H. Unless otherwise indicated, bolt, and screw heads shall be flat countersunk in exposed faces of ornamental or finished character; elsewhere as required. Cut off bolts, screws, etc., where exposed, flush with nuts, or other adjacent metal. Except as otherwise required, weld shop-assembled connections; welds, bolts, or machine screws may be used for field connections. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous. Exposed fastenings shall be the same materials, color, and finish as metal to which they apply, unless otherwise required.

I. Make up threaded connections tightly so that threads will be entirely concealed by fittings.

J. Allow for thermal movement resulting from a maximum temperature range change of 120 degrees F ambient and 180 degrees F surface by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and night time sky heat loss.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.All work shall be designed for adjustment to field variation, fitted with proper joints and intersections, adequately anchored in place.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Perform field welding in accordance with AWS D1.1/D1.1M.

D. Obtain approval prior to site cutting or making adjustments not scheduled.

E. Work to be built in with masonry shall be of form required for anchorage, or be provided with suitable anchors, expansion shields, toggle bolts, etc. as required for proper anchorage. Fastening to wood plugs in masonry shall not be permitted.

F. Install all supporting members, fastening, framing, hangers, bracing, brackets, straps, bolts, angles, and the like required to set, connect work rigidly and properly to structural steel, masonry, other construction.

G. Ease all corners on steel installed, and exposed to view, that is located less than 10’-0” above finished floor. Provide consistent rounded corners.

H. Setting bearing plates: Clean concrete and masonry bearing surfaces of bond reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates. Set bearing and leveling plates on wedges, shims or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

I. Bollard Installation - Permanent Set:
   1. Anchor by setting pipe sleeves into concrete. Fill annular space between bollard and concrete solidly with non-shrink, non-metallic grout. Slope grout up toward internal sleeve.
   2. Anchor by directly setting bollards into 8" minimum depth core-drilled concrete holes 3/4" greater diameter than the bollard. Fill annular space between bollard and concrete solidly with non-shrink, non-metallic grout. Slope grout up toward internal sleeve.
   3. Anchor bollards in concrete footings. Support and brace bollards in position in concrete footings until concrete has been placed and cured.
   4. Fill permanently installed bollards solidly with concrete, mounding top surface.

J. Immediately after erection, clean field welds, bolted connections and abraded areas of shop paint, and paint exposed areas with the same materials as used for shop painting, complying with SSPC-PA1. Apply by brush or spray to provide a minimum 2 mil dry film thickness. Clean field welds, bolted connections and abraded areas of galvanized surfaces to comply with ASTM A780.

3.04 TOLERANCES

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

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 05 51 00
METAL STAIRS AND RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Stairs with concrete filled treads.

B. 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. Section 03 30 00 - Cast-in-Place Concrete: Concrete fill in stair pans; mesh reinforcement for landings.

D. Section 05 12 00 - Structural Steel.

E. Section 09 91 23 - Interior Painting: Paint finish.

F. 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 1992.

S. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.

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 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 stair, tube edging 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.

1.06 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 stair, and railing assemblies complying with applicable codes.

B. Stairs: Engineer, fabricate and install steel stairs in accordance with NAAMM Metal Stair Manual and to withstand the effects of gravity loads and the following structural loads without exceeding the allowable design working stress of the materials involved. Apply each load to produce the maximum stress in each component of steel stairs.
   1. Uniform Load: 100 lbf/sq.ft.
   2. Concentrated Load: 300 lb applied on an area of 4 sq. in.
   3. Uniform and concentrated loads need not be assumed to act concurrently.
   4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
   5. Limit total load deflection of treads, platforms and framing members to 1/360 of span or 1/4 inch, whichever is less.
   6. Limit live load deflection of treads, platforms and framing members to L/480.
   7. Stiffness: Design stairs that span more than 15 feet with no vibration. Limit Frequency to a minimum of 5 to 6 Hz.
   8. Seismic Performance: Stairs designed to withstand the effects of earthquake motions determined according to ASCE 7.
      a. Component Importance Factor: 1.5.
      b. No permanent inelastic deformation occurs under movements equal 2.5 percent interstory drift, minimum.

C. 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 STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, 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 METAL STAIRS WITH CONCRETE TREADS

A. Jointing and Finish Quality Level:
   1. Egress Stair: Commercial, as defined above.

B. Type: Straight

C. Risers: Closed.

D. Treads: Metal pan with field-installed concrete fill.
   1. Concrete Depth: 1-1/2 inches, minimum.
   2. Tread Pan Material: Steel sheet.
   3. Tread Pan Thickness: As required by design; 10 gage inch minimum.
   4. Pan Anchorage to Stringers: Continuously welded, from top or bottom.
   5. Concrete Reinforcement: Welded wire mesh.
   6. Concrete Finish: See Finish Schedule.

E. Risers: Same material and thickness as tread pans:
   1. Riser/Nosing Profile: Sloped riser with rounded nosing of minimum radius.
   2. Nosing Depth: Not more than 1-1/2 inch overhang.
   3. Nosing Return: Flush with top of concrete fill, not more than 1/2 inch wide.

F. Stringers: As detailed on the Drawings.
   1. Stringer Depth: As required for structural loads.
   2. End Closure: Sheet steel of same thickness as risers welded across ends.

G. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.

H. Finish: Shop prime painted.

I. Under Side of Stair: Where exposed to view, to be finished same as specified for other exposed to view surfaces.

2.03 2.03 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.

2.04 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.

2.05 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.

2.06 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.

2.07 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 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 waking 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.

2.08 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. Stairs 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.

J. Steel Stair Installation
1. Set units accurately in location, alignment, and elevation, with edges and surfaces level, plumb and free of rack. Measure from established lines and levels.
2. Install steel stairs by welding stair framing to steel structure or to weld plates cast into concrete and/or masonry except where otherwise indicated. Provide temporary bracing as required.
3. Fit exposed connections accurately together to form hairline joints. Weld field connections of stairs.
4. Set steel stair base plates at slabs on adjustable devices. After stairs have been positioned, tighten anchor bolts. Conceal the base plates in final installation. Use nonmetallic, non-shrink grout and pack grout solidly between bearing surfaces and plates to ensure no voids remain.
5. Completed stair installation shall be rigid and free from vibration.

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 AWPA 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 AWPA 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 AWPA U1 and ICC (IBC). Unless otherwise permitted by standard U1 and the building code, marking shall include the

phrase: AWPA 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 AWPA 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 20 00
FINISH CARPENTRY & ARCHITECTURAL MILLWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Custom woodwork items including but not limited to:
   1. Fixed Wall Shelving – Plastic-Laminate Faced.
   2. End Panels, Wall Cleats and Supports for Counters – Plastic Laminate Faced.
   3. Window Sills - Solid Surface.
   4. Medium Density Overlay (MDO) Paneling.
   5. Plastic Laminate Paneling.

B. Hardware and attachment accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 10 54 - Wood Blocking and Curbing: Concealed wood blocking.

B. Section 06 41 00 - Architectural Wood Casework: Shop fabricated custom cabinet work.

C. Section 12 36 00 – Countertops: Solid surface material for window sills.

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

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard.

B. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards.

D. AWPA U1 - Use Category System: User Specification for Treated Wood.

E. BHMA A156.9 - American National Standard for Cabinet Hardware.

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 technical information for all factory fabricated products, hardware, and accessories specified herein. Provide data on fire retardant treatment materials.

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 of all items of finish carpentry and millwork. Indicate materials, species, arrangement, clearances, erection details, finishes and surfacing, thickness, size, component profiles, fastening methods, jointing details, accessories, and hardware, to a minimum scale of 1-1/2 inch to 1 ft.

E. Samples: Submit samples of finished hardwood. Submit confirmation samples of solid surfacing and laminate wall panel finishes. Upon request, submit hardware samples.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this Section with minimum five years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect woodwork and millwork during transit, delivery, storage and handling to prevent moisture and other damage, soiling and deterioration.

B. Do not deliver woodwork and millwork until environmental conditions are suitable (enclosed, dry, with operating HVAC system), and painting and similar operations that could damage woodwork and millwork are complete.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI//AWMAC/WI Architectural Woodwork Standards for Premium Grade.

B. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.
   1. In general, shall be Class C minimum per ASTM E84, : Flame spread 75, maximum; Smoke developed 450, maximum

2.02 SHEET MATERIALS

A. Panel Core: Medium density fiberboard (MDF); ANSI A208.2, Class MD or MD-EXT as applicable, no formaldehyde-added (NAUF) or certified ultra-low emitting formaldehyde (ULEF), 47 pcf min density, composed of wood chips, sawdust, or flakes, made with water resistant adhesive; of grade to suit application; sanded faces.
   1. Applications for moisture resistant type (MR): Panels and aprons below sinks, window sills, and where indicated.
   2. Application for fire-resistant type (FT): For plastic laminate facings for wall panels and casework located within corridors and egress area, and where indicated on the Drawings
   3. Modulus of Elasticity: 405,000 psi minimum.
   4. Screw Holding Face: 250 lbs minimum.
   5. Screw Holding Edge: 225 lbs minimum.

B. Medium Density Overlay Plywood (MDO): Made of laminated fir veneer core (common plywood) with ovelaid of pressed resin saturated paper fiber material

2.03 PLASTIC LAMINATE MATERALS

A. Plastic Laminate: NEMA LD 3; See Finishes Legend for products and colors.
   1. Manufacturers and Colors: See Finish Legend.
   2. Horizontal Surfaces: HGL 0.039 inch nominal thickness.
   3. Vertical Surfaces: VGS 0.028 inch nominal thickness.

B. Concealed surfaces: Low Pressure Laminate: Melamine; colors as selected, and matte surface texture.

C. Laminate Backing Sheet: NEMA LD 3, BKL; undecorated plastic laminate.

D. Laminate Adhesive: Type recommended by laminate manufacturer to suit application; not containing formaldehyde or other volatile organic compounds.

E. Edge Banding:
   1. Thick Edgebanding:
      a. Application: Typical edgebanding, unless otherwise noted.
      b. Extruded ABS or PVC, 3 mm thickness, extruded flat shaped with eased edges; smooth finish; for machine application with hot melt adhesive; through colors; of width to match component thickness and length as required; colors as selected by the Architect from the manufacturer's full range of colors.
   2. Thin Edgebanding:
      a. Application: Laminate wall paneling.
      b. Extruded PVC, 1 mm thickness, finish to match laminate face; for machine application with hot melt adhesive; through colors; of width to match component thickness and

length as required; colors as selected by the Architect from the manufacturer's full range of colors.

3. Products:
   a. Charter Industries; Edge Banding.
   b. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 FASTENERS

A. Fasteners: Nails, screws, and other anchoring devices shall be of size, material, finish and type to suit application to provide secure attachment, concealed where possible; hot-dipped galvanized finish, complying with ASTM A153 in exposed locations of high humidity.

B. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.

2.05 HARDWARE

A. Counter Support Bracket: Sizes as required up to 30" deep counters; concealed vertical support leg bolted to studs and concealed behind gypsum board. Locations as indicated on the Drawings, but in no case further spaced than 32 inches on center.
   1. Finish: Powder coat finish. Color as selected from manufacturer's standard range.
   2. Exposed and concealed vertical leg styles as indicated on the Drawings.
   3. Product:
      a. Rakks; EH-1800 Series.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fixed Shelf Brackets: Aluminum with clear powder coat, exposed bracket and fasteners.
   1. Thickness: 1/4 inch.
   2. Size: As required for application.
   3. Product:
      a. A&M Hardware; Aluminum Brackets.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Concealed panel clip system for wood panels; of size and type to suit application and as follows:
   1. Heavy Duty Panel Clip and Rail (Z-Clip) Hanger System: Aluminum panel z-clips attached to panels and continuous rails attached to substrate for friction fit to wall tracks.
      a. Application: MDO paneling in Gymnasium.
      b. Stand-off Dimension: 0.375 inch.
      c. Lift-off Dimension: 0.375 inch.
      d. Product:
         1) Eagle Aluminum; ZCP-3838 Eagle-Clips.
         2) Substitutions: See Section 01 60 00 - Product Requirements.
   2. Medium Duty Panel Clip and Rail (Z-Clip) Hanger System: Aluminum panel z-clips attached to panels and continuous rails attached to substrate for friction fit to wall tracks.
      a. Application: Plastic laminate paneling in corridors.
      b. Stand-off Dimension: 0.24 inch.
      c. Lift-off Dimension: 0.375 inch.
      d. Product:
         1) Eagle Aluminum; ZCP-375 Eagle-Clips.
         2) Substitutions: See Section 01 60 00 - Product Requirements.

2.06 ACCESSORIES

A. Sealants: Comply with requirements of Section 07 90 05 – Joint Sealants.

B. Lumber for Shimming, Blocking, and Furring: Softwood or hardwood lumber, kiln dried to less than 15% moisture content. Provide fire retardant treated type.

2.07 FABRICATION

A. The millwork details represented on the Drawings are not intended to indicate all of the framing, blocking and sheathing required for the proper construction and support of millwork. It shall be the Contractor's responsibility to properly detail such work for lasting strength and stability, and to accurately represent it on Shop Drawings.
   1. Note: There shall be no unfinished wood products. If not covered with laminate products, paint wood surfaces in concealed or semi-concealed areas.

B. In general, woodwork shall be assembled and installed using concealed fasteners, unless otherwise approved by the Architect. Fasteners shall be concealed, blind nailed, or countersunk with matching plugs. Secure woodwork to anchors or blocking built-in or directly attached to substrates.

C. Trim shall be fastened in place with finishing nails, set heads for putty. Woodwork shall be sanded as necessary to remove irregularities and machine marks. The use of finishing screws shall not be permitted. All work shall be left free of blemishes and defects.

D. Joints in all work shall be tight and formed to conceal shrinkage. Running trim shall be in long lengths and joined only where solid fastenings can be made. End joints in built-up members shall be well distributed. Exterior corners shall be mitered, and interior corners and/or angles shall be coped. All edges shall be slightly eased; edges of solid wood members 3/4" thick or less to 1/16"; edges of rails and similar members more than 3/4" thick to 1/8".

E. Complete fabrication in the shop, including assembly, finishing, and hardware application, to the maximum extent possible, before shipment to the site. Disassemble components only as necessary for shipment and installation. Pre-cut openings, where possible, to receive hardware, fixtures, electrical work and similar items.

F. Condition woodwork to average prevailing humidity conditions in installation areas before installation. Install woodwork level, plumb, true and straight to a tolerance of 1/8" to 96 inches. Shim as required with concealed shims. Scribe and cut woodwork to fit, and refinish cut surfaces and repair damaged finish at cuts.

G. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting. Closure panels/strips, end panels and trim shall be provided as required for a complete, finished installation.

2.08 FABRICATION - SOLID SURFACE

A. See Section 12 36 00 – Countertops for material.

B. Solid surface shall be fabricated and installed in strict accordance with the manufacturer's recommendations. Form field joints using recommended adhesive with joints inconspicuous in finished work.
   1. Fabrication Tolerances: Variation in component size: 1/8". Variation in location of openings: 1/8".
   2. Keep surfaces and hands clean during installation. Remove excess adhesives, sealants and other stains.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI Architectural Woodwork Standards requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

D. Install counter supports secured through stud web and blocking as recommended by the manufacturer. Locate supports as indicated on the Drawings, but in no case further apart than 48 inches for 25 inch deep counters and 32 inches for deeper counters.

E. MDO Paneling Installation:
   1. Seal all edges and prime all edges and faces of panels.
   2. Pin panels with finish screws after they are set in specified Z-clips to prevent removal or movement of panels.
   3. Field paint panels as indicated in Finish Legend and specified in Section 09 91 23 – Interior Painting.

3.03 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

3.04 CLEANING AND PROTECTION OF WORK

A. Erect and maintain temporary protective barriers until such time as permanent construction is in place and all danger of damage or defacement is past.

B. Repair damaged and defective woodwork, where possible to eliminate functional and visual defects. Where not possible to repair, replace woodwork. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop applied finishes to restore damaged or soiled areas.

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 06 20 00 - Finish Carpentry and Architectural Millwork.

C. Section 10 51 29 – Phenolic Lockers.

D. Section 12 36 00 - Countertops.

E. 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, Knape 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: Knape 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 Knape & 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 ¾” 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 11 13
BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Bituminous dampproofing for the following applications:
   1. Exterior face of below-grade foundations and walls.
   2. Structural steel embedded in concrete slabs.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete substrate.

B. Section 07 21 00 - Thermal Insulation: Insulation used for protective cover.

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

1.03 REFERENCE STANDARDS

A. ASTM D449/D449M - Standard Specification for Asphalt Used in Dampproofing and Waterproofing.

B. ASTM D1187/D1187M – Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.

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 properties of primer, bitumen, and mastics.

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 Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application until dampproofing has cured.

PART 2 PRODUCTS

2.01 BITUMINOUS DAMPPROOFING

A. Bituminous Dampproofing: Cold-applied water-based emulsion; asphalt with mineral colloid or chemical emulsifying agent; without fiber reinforcement; asbestos-free; suitable for application on vertical and horizontal surfaces.
   1. Composition: ASTM D1187/D1187M, unreinforced, Type I - Continuous water exposure within few days after drying.
   2. VOC Content: Not more than permitted by local, State, and federal regulations.
   3. Applied Thickness: 1/16 inch, minimum, wet film.
   4. Products:
      a. Karnak Corporation; 100 Non-Fibered Emulsion.
      b. W.R. Meadows, Inc.; Sealmastic Emulsion Type II (brush/spray-grade).
      c. Henry Company; 788 Non-Fibered Asphalt Emulsion.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are acceptable prior to starting this work.

B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.

C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces not designated to receive dampproofing.

B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.

C. Do not apply dampproofing to surfaces unacceptable to manufacturer. Do not apply over frost-covered surfaces.

D. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

E. Use material as it comes in the container; thinning shall not be permitted.

F. Do not apply dampproofing when temperature is below 40 degrees F.

3.03 APPLICATION

A. Perform this work in accordance with manufacturer's instructions.

B. Apply damproofing with roller,or spray applied.

C. Apply dampproofing in one coat, continuous and uniform, at a rate of 3 gallons/ 100 sq ft .

D. Apply from 2 inches below finish grade elevation down to top of footings or as indicated on Drawings.

E. Seal items watertight with mastic, that project through dampproofing surface.

F. Backfill against dampproofing after 48 hours of exposure to ensure cure.

END OF SECTION

SECTION 07 21 00
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at cavity wall construction, perimeter foundation wall, and exterior wall behind masonry veneer, and MCM siding wall finish.

B. Acoustic batt insulation in interior partitions.

C. Thermal batt insulation at miscellaneous locations indicated on the Drawings.

D. Foam insulation sealant for joints and small gaps.

E. 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 21 19 - Foamed-In-Place Insulation: Plastic foam insulation other than boards.

C. Section 07 25 00 - Weather Barriers: Separate air, water and vapor barrier materials.

D. Section 07 42 64 – Metal Composite Material Wall Panels: Cladding support system in plan with exterior wall continuous insulation.

E. Section 07 53 00 - Elastomeric Membrane Roofing: Insulation specified as part of roofing system.

F. Section 07 84 00 - Firestopping: Safing insulation as a component of firestopping assemblies.

G. Section 09 21 16 - Gypsum Board Assemblies: Partitions for acoustic insulation.

H. 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 C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.

G. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

H. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2019 (Reapproved 2022).

I. 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.

J. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics; 2016 (Reapproved 2023).

K. ASTM D2126 - Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging; 2020.

L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

M. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

N. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024.

O. ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres; 2020.

P. NFPA 285-19 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2019.

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: Evalulation 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 MOCK-UPS

A. Mock-Ups: Provide insulation for exterior wall mock-ups specified in Section 04 20 00 and Section 07 42 64.

B. Mock-up panels shall demonstrate actual wall construction, detailing and workmanship.

C. No work shall progress until the Architect has reviewed mock-up panels. Panels shall be revised as necessary to secure the Architect’s acceptance and shall then become the standard of comparison for all related exterior wall work.

D. Mock-up panels shall not be destroyed or moved until the Work is complete and accepted by the Architect. Upon completion of construction, mock-ups shall be removed.

1.07 FIELD CONDITIONS

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

1.08 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 FOAM BOARD INSULATION MATERIALS

A. Rigid Wall Insulation Board: Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, comply with ASTM C1289. Type I - Faced with aluminum foil on both major surfaces of the core foam or coated-glass-facer. Class 1 - Non-reinforced core foam.
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.

2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
3. Water Vapor Permeance: 1.2 perm, maximum, at 1 inch thickness, and when tested in accordance with ASTM E96/E96M, desiccant method.
4. Compressive Strength: 20 psi, minimum.
5. Thermal Resistance, R-value: At 1-1/2 inch thick; 9.0, minimum, at 75 degrees F.
6. Board Size: 48 x 96 inch.
7. Board Thickness: 2 inch thickness, applied in 2 layers, unless otherwise indicated on drawings.
8. Board Edges: Square.
9. Complies with fire resistance requirements shown on the drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
10. Product: (Basis of Design for an approved NFPA 285 system).
    a. Hunter; XCI Foil Class A Plus.
    b. Henry Company / Carlisle Coatings & Waterproofing; R2+ Matte (Class A).
    c. Atlas Roofing Corporation; EnergyShield Pro Wall Insulation.
    d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Rigid Perimeter Insulation Board: Extruded polystyrene (XPS) board insulation: Comply with ASTM C578 with natural skin surfaces.
1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.
2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
3. Smoke Developed Index (SDI): 175 maximum, when tested in accordance with ASTM E84.
4. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88), minimum, per 1 inch thickness at 75 degrees F mean temperature.
5. Board Edges: Square.
6. Type and Water Absorption: Type IV, 0.3 percent by volume, maximum, by total immersion.
7. Blowing Agent: HCFC-free, low GWP agents.
8. Board Thickness:
9. Perimeter Foundation Walls: : 2 inch thickness, applied in 2 layers, unless otherwise indicated on drawings.
10. Products:
    a. DuPont de Nemours, Inc; Styrofoam ST-100 Insulation Board.
    b. Owens Corning Corporation; Foamular NGX 250.
    c. Substitutions: See Section 01 60 00-Product Requirements.

2.02 BATT & FIBER INSULATION MATERIALS

A. Mineral Fiber Insulation Board: Semi-rigid mineral fiber, ASTM C612 or C553; unfaced.
1. Flame Spread Index: 25 or less, when tested with facing, if any, in accordance with ASTM E84.
2. Smoke Developed Index: 50 or less, when tested with facing, if any, in accordance with ASTM E84.Board Edges: Square.
3. Thermal Resistance: R-value of 4.2 per inch at 75 degrees F, minimum, when tested in accordance with ASTM C518.
4. Board Edges: Square.
5. Board Thickness: As indicated on the Drawings.
6. Minimum Density: 4.4 pcf, nominal.
7. Maximum Density: 6.0 pcf, nominal.
8. Products:
    a. Rockwool; Cavityrock.
    b. Owens Corning Corporation: Thermafiber; RainBarrier.
    c. Johns Manville: JM Cladstone 45.

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

B. 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.

C. 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.

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

2.03 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.

2.04 ACCESSORIES

A. Insulation Fasteners:
1. Length as required for thickness of insulation material and penetration of substrate.
2. Thread and tip types as required for substrate material.
3. Products:
a. TruFast Walls, a Division of Altenloh, Brinck & Co. US, Inc; Grip-Deck TubeSeal.
b. Hilti, Inc.; X-IE Series Insulation Fastener
c. Substitutions: See Section 01 60 00 - Product Requirements.

B. 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 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Exterior foundation wall perimeters shall have vertical rigid insulation installed to extent as indicated on Drawings.

B. Apply adhesive to back of boards in a pattern to ensure adhesion to the foundation dampproofing.

C. Install boards horizontally on foundation perimeter.
   1. Place boards to maximize adhesive contact.
   2. Install in running bond pattern.
   3. Butt edges and ends tightly to adjacent boards and to protrusions.

D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane

E. Install concrete-faced insulation panels in accordance with manufacturer's requirements.

3.03 BOARD INSTALLATION AT CAVITY WALLS

A. Install horizontally on walls.
   1. Install in running bond pattern.
   2. Install boards in 2 layers with joints staggered.
   3. Butt edges and ends tightly to adjacent boards and to protrusions.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

C. Install insulation with adhesive.
   1. Verify compatibility of adhesive with weather barrier and insulation manufacturers.
   2. Apply compatible adhesive to substrate, per adhesive manufacturer, weather barrier manufacturer, and insulation manufacturer recommendations.
   3. Application rate and spacing shall be evenly distributed and minimum necessary per jobsite conditions as required by insulation & adhesive manufacturers to hold the continuous insulation in place until cladding attachment system can be installed to permanently secure the insulation board.

D. Mechanical Fasteners: If necessary, provide supplementary mechanical fasteners.
   1. Install in accordance with manufacturer installation instructions.
   2. Application rate and spacing shall be evenly distributed and minimum necessary per jobsite conditions as required by insulation & fastener manufacturers to hold the continuous insulation in place until cladding attachment system can be installed to permanently secure the insulation board.
   3. Regularly inspect interior side of wall sheathing for fastener locations that are not contacting studs. Remove errant fasteners and seal in accordance with weather barrier manufacturer's instructions. Fill hole in continuous insulation with foam insulation sealant compatible with rigid insulation.

3.04 FIBEROUS BATT INSTALLATION

A. Install fiberous 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 fiberous 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.

3.05 FOAM INSULATION SEALANT INSTALLATION

A. Install foam insulation sealant continuously to completely fill all gaps and voids at insulation boards, at voids in deck flutes, at voids around window and door frames, other exterior thermal envelope penetrations and at locations as indicated on the Drawings.

B. 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.

C. 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.

3.06 PROTECTION

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

END OF SECTION

SECTION 07 21 19
FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Foamed-in-place insulation.

B. Protective intumescent coating

1.02 RELATED REQUIREMENTS

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

1.03 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.

B. ASTM D1622/D1622M - Standard Test Method for Apparent Density of Rigid Cellular Plastics 2020.

C. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics 2019.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.

E. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).

F. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2004 (Reapproved 2012).

G. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials 2021a.

H. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components 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 product description, insulation properties, preparation requirements, fire test reports, VOC content, MSDS sheets, certified test reports showing compliance with specified performance values and verification of minimum foam thickness to achieve the specified R-value.

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 12" x 12" sample of insulation on specified wall substrate.
   2. Submit daily test shot samples of foamed-in-place insulation from each batch of foam.

E. Certificates:
   1. Certify in writing that products of this section meet or exceed specified requirements.
   2. Certify in writing acceptance of all substrate surfaces prior to insulation installation.
   3. Certify in writing installer is approved by the manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this Section, with not less than fifteen years of documented experience.

B. Applicator Qualifications: Applicator shall be trained and certified by the insulation manufacturer, shall specialize in performing work of the type specified, with minimum five years of experience.

C. Conform to applicable code for flame and smoke limitations.

1.07 DELIVERY, STORAGE AND HANDLING

A. Materials shall be delivered in manufacturer's original sealed containers clearly labeled with manufacturer's name, product identification, safety information, net weight and expiration date.

B. Materials shall be stored in a safe manner within temperature limits specified by the materials manufacturer.

1.08 FIELD CONDITIONS

A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.

B. Do not apply foam when temperature is within 5 degrees F of dew point.

C. Do not apply to unsatisfactory substrate conditions.

PART 2 PRODUCTS

2.01 MATERIALS

A. Foamed-In-Place Insulation, Closed-Cell: Medium-density, 2-component polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
   1. Regulatory Requirements: Comply with applicable code for flame and smoke and concealment limitations.
   2. Aged Thermal Resistance, ASTM C518: R-value of 6.7 (deg F hr sq ft)/Btu, per 1 inch thickness after aging for 180 days at 41 degrees F.
   3. Water Vapor Permeance, ASTM E96: 0.7 perm max at 2" thickness.
   4. Water Absorption, ASTM D2842: < 3 % by volume, max..
   5. Air Permeance, ASTM E2178: 0.001 cfm/sq ft, maximum at 1.5 psf.
   6. Closed Cell Content: At least 96 percent.
   7. Surface Burning Characteristics, ASTM E84: Flame Spread Index 25, Smoke Developed Index 450.
   8. Products:
      a. BASF Corporation; Walltite HFO.
      b. Icynene Inc; Icynene Proseal HFO.
      c. Johns Manville; JM Corbond IV.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACCESSORIES

A. Primer: As required by insulation manufacturer.

B. Protective Coating: Intumescent coating of type recommended by insulation manufacturer and as required to comply with applicable codes.
   1. Coating Type: Single component, water-based.
   2. Application: Apply using brush, roller, or airless sprayer. Apply protective coating at all concealed interior areas.
   3. Surface Burning Characteristics: Flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
   4. Products:
      a. Product as recommended by insulation manufacturer for application conditions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify work within construction spaces or crevices is complete before insulation application.

B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation adhesion.

C. Examine substrate surfaces to receive insulation system materials and conditions under which the system will be installed. Do not proceed with the Work until unsatisfactory conditions have been corrected by the Contractor in a manner acceptable to the system installer and in compliance with the system manufacturer's standards.
   1. Prior to beginning work, examine all substrates for soundness, such as tightness of connections, crumbling or looseness of surface, and other conditions that would affect the installation.
   2. Notify the Contractor and Architect of any adverse or unsatisfactory conditions. Work shall not proceed until such conditions are corrected and conditions are accepted by the insulation system contractor.

D. The insulation system contractor shall submit a certificate stating acceptance of all substrate surfaces prior to installation of the insulation system, including, but not limited to:
   1. Substrate surfaces are solidly supported and secured.
   2. Verify substrate surfaces are suitable for proper bonding of the insulation system materials.

3.02 PREPARATION

A. Mask and protect adjacent surfaces from over spray or dusting.

B. Ventilate area to receive insulation and follow manufacturer's instructions for safe working conditions for workers and where applicable, building occupants.

C. Apply primer in accordance with manufacturer's instructions.

D. Verify that window frames, door frames, wiring, conduit boxes, etc are secured appropriately so that expansion of foam does not cause their displacement.

3.03 APPLICATION

A. Apply insulation in accordance with manufacturer's instructions. Insulation shall be installed at a thickness of no more than 2.75 inches per pass.

B. Apply insulation by spray method, to a uniform monolithic density without voids, in consecutive passes. Observe installation tolerance from specified thickness.

C. Measures shall be taken to contain field trimmings of oversprayed areas. They shall be removed on a regular basis to minimize trimmings from being blown around the site.

D. Monitor and maintain the component ratio and mix of the components of the urethane chemicals in accordance with the manufacturer's product requirements. See Field Quality Control below.

E. Apply to achieve thickness as indicated in drawings.

F. Trim foam flush with the inside surface. Remove foam form finished surfaces such as window glass, casings, and gypsum board.

G. Patch damaged areas.

H. Trim excess away for applied trim or remove as required for continuous sealant bead.

I. Apply protective coating monolithically, without voids, to fully cover foam insulation, to achieve fire protection required.

3.04 PROTECTION

A. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION

SECTION 07 25 00
WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Weather Barrier membrane, transition membrane and wall flashings for a complete system to perform as a combined continuous air, water and vapor barrier.

1.02 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold Formed Metal Framing: Sheathing substrate for weather barrier.

B. Section 07 21 00 - Thermal Insulation: Rigid cavity wall insulation board.

C. Section 07 53 00 - Elastomeric Membrane Roofing: Air-vapor barrier installed as part of the roofing system.

D. Section 07 90 05 - Joint Sealers: Sealant materials and installation techniques.

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

1.03 DEFINITIONS

A. Air Barrier: Air-tight barrier made of material that is air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.

B. Vapor Retarder: Air-tight barrier made of material that is relatively water vapor impermeable, to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.
   1. Water Vapor Permeance: For purposes of conversion, 57.2 ng/(Pa s sq m) = 1 perm.

C. Water-Resistive Barrier: Water-shedding barrier made of material that is moisture-resistant, to the degree specified, intended to send water to outside of the wall assembly.

1.04 REFERENCE STANDARDS

A. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers; 2022.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials, 2023a.

C. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials, 2022a, with Editorial Revision (2023).

D. ASTM E283 - Test Method for Determining Rate of Airflow Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen; 2019.

E. ASTM E330 - Test Method for Structural Performance of Exterior Windows, Curtain Wall and Doors by Uniform Static Air Pressure Differential; 2021.

F. ASTM E331 - Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air pressure Difference;. 2023.

G. ASTM E547 - Test Method for Water penetration of Exterior Windows, Curtain walls and Doors by Cyclic Static Air Pressure Difference; 2024.

H. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors; 2020.

I. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2021a.

J. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers; ICC Evaluation Service, Inc, 2016, with Editorial Revision (2021).

K. ICC-ES AC212 - Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing; ICC Evaluation Service, Inc.; 2015, with Editorial Revision (2022).

L. NFPA 285 – Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2023.

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 material characteristics, performance criteria, and 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. Shop Drawings: Provide drawings of special joint conditions, terminations, flashings, penetrations, window and door openings and treatment of substrate joints and cracks.

E. Manufacturer's Installation Instructions: Indicate preparation.

F. Samples: Submit representative samples of sheet membrane, sheet seal, transition membrane, and membrane wall flashing.

G. Certifications:
1. Submit certification by weather barrier manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).
2. Submit weather barrier manufacturer's certification of compatibility of weather barrier with all materials in contact with it.
3. Evalulation Report indicating submitted products listed in wall assembly tested to NFPA 285. Provide reference to wall components provided in other Sections.

1.07 QUALITY ASSURANCE

A. Manufacturer: Weather barrier systems shall be manufactured and marketed by a firm with a minimum of fifteen years of experience in the production and sales of waterproofing. Manufacturers proposed for use, but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past five years.

B. Installer: A company with at least five years of experience with the installation of products specified herein and having successfully completed other Projects of similar scope, and approved by the weather barrier manufacturer.
1. Written confirmation or certification from the Waterproofing Manufacturer that the installer has been trained and is recognized by the manufacturer as suitable for the execution of the work.
2. 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.

C. Materials Source Limitations: For each type of material required for the work of this Section, provide primary materials and weather barrier accessories that are the products of one manufacturer.

1.08 PERFORMANCE REQUIREMENTS

A. General: Weather Barrier shall be capable of performing as a continuous vapor, air and water resistive barrier, flashed to discharge to the exterior incidental condensation or water penetration. Weather barrier assemblies shall be capable of accommodating substrate movement and sealing of substrate expansion and control joints, construction material changes, penetrations, tie-ins to embedded flashing, tie-ins to installed waterproofing, and

transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

1.09 MOCK-UPS AND SAMPLE INSTALLATIONS

A. Sample Installation: Prior to commencement of the complete installation of the weather barrier system, a sample installation shall be provided to verify details, tie-ins and to demonstrate the required quality of materials, installation and workmanship.
   1. The sample installation shall be applied to a constructed exterior wall section, 8 feet long and 8 feet wide, at a location to be determined by the Architect, incorporating brick shelf, window and door frame head, jamb and sill flashing and masonry ties.
   2. No work shall progress until the Architect has reviewed the sample installation. Sample installation shall be revised as necessary to secure the Architect's acceptance.

1.10 PRE-INSTALLATION MEETING

A. Pre-Installation Conference: A pre-installation conference shall be held at least two weeks prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include but not be limited to the following:
   1. Review of submittals.
   2. Review of surface preparation, minimum curing period and installation procedures.
   3. Review of special details and flashings.
   4. Sequence of construction, responsibilities and schedule for subsequent operations.
   5. Review of mock-up requirements.
   6. Review of inspection, testing, protection and repair procedures.

B. Manufacturer's Representative: Make arrangements necessary to have a trained employee of the manufacturer on-site prior to installation, at 25% completion, and final completion; as well as any other necessary re-inspections during membrane work to review installation procedures. A field report shall be issued to the Contractor and Architect after each visit; indicating the quality of the work and identifying any issues and resolutions.

1.11 DELIVERY, STORAGE AND PROTECTION

A. Materials shall be delivered in manufacturer's original sealed containers clearly labeled with manufacturer's name, product identification, safety information, net weight, and expiration date.

B. Materials shall be stored in a safe manner within temperature limits specified by the materials manufacturer.

C. Avoid spillage. Immediately notify Owner and Architect if spillage occurs and start clean up procedures. Clean spills and leave area as it was prior to spill.

D. Observe safety and environmental measures indicated in manufacturer's MSDS, and mandated by federal, state and local regulations.

1.12 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

1.13 WARRANTY

A. Provide the manufacturer's five-year materials warranty, covering the primary weather barrier, accessory sealant and membrane materials against failure to cure, or achieve airtight and watertight seal, or to adhere.

PART 2 PRODUCTS

2.01 WEATHER BARRIER MATERIALS

A. Weather Barrier System: Fire-Resistant Self-Adhered Composite Membrane Air Barrier: Membrane consisting of rubberized-asphalt adhesive laminated to fire-resistant aluminum foil/HDPE composite facer with removable silicone-coated plastic release paper.

1. Air Permeance: 0.0002 cfm/sq ft nominal leakage when tested at 1.57 psf pressure difference in accordance with ASTM E2178.
2. Water Vapor Permeance: 0.01 perm, measured in accordance with ASTM E96/E96M using Procedure B, Water Method.
3. Water Penetration Resistance Around Nails, ASTM D1970: Pass.
4. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 90 days of weather exposure.
5. Surface Burning Characteristics, ASTM E84: Flame spread index of 25 or less, smoke developed index of 450 or less.
6. Application Temperature: 40 degrees F, minimum. Provide low temperature version if required for installation sequencing.
7. Comply with NFPA 285 wall assembly requirements.
8. Water Resistance: Comply with applicable water-resistive requirements of ICC-ES AC38.
9. Manufacturers:
    a. Henry Company; Metal Clad 705FR.
    b. GCP Applied Technologies; Perm-A-Barrier Aluminum Wall Membrane.
    c. W.R. Meadows; Air-Sheild Aluminum Sheet Membrane.
    d. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 2.02 ACCESSORIES

A. Membrane Flashing: Flexible membrane flashing, self-adhesive rubberized asphalt integrally bonded to cross-laminated, high-density polyethylene film to provide a min. 40 mil thick membrane. Factory cut strips, width as appropriate for installation. Product as recommended by Weather Barrier manufacturer.
1. Permeance, ASTM E96: 0.05 perms.
2. Puncture Resistance, ASTM D570: 40 lb, min.
3. Products:
    a. Carlisle Coatings and Waterproofing, Inc.; Sure-Seal Pressure-Sensitive Elastoform.
    b. GCP Applied Technologies; Perm-A-Barrier Wall Flashing.
    c. W.R. Meadows; Air-Sheild Aluminum Sheet Membrane.
    d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Transition Membrane: 40 mils total thickness; self-adhesive rubberized asphalt integrally bonded to cross-laminated high-density polyethylene film with disposable silicone-coated release paper. Factory cut strips, width as appropriate for installation. Product as recommended by Weather Barrier manufacturer.
1. Permeance, ASTM E96: 0.05 perms.
2. Puncture Resistance, ASTM D570: 40 lb, min.
3. Products:
    a. Henry Company; Metal Clad 705FR or 705FR LT.
    b. GCP Applied Technologies; Perm-A-Barrier Aluminum Wall Membrane.
    c. W.R. Meadows; Thru-Wall Flashing.
    d. Substitutions: See Section 01 60 00 - Product Requirements.

C. Surface Conditioner / Primer: Required, as recommended by coating manufacturer and suitable to the substrate.

D. Thinners and Cleaners: As recommended by material manufacturer.

2.03 SEALANTS

A. Sealants: As recommended by the weather barrier system manufacturer for each application. Sealants shall have been tested for chemical and adhesive properties in relation to adjacent surface materials and approved in writing by the weather barrier system manufacturer.

B. Sealant Backers: As specified in Section 07 90 05.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this Section. Notify the Contractor, in writing, of circumstances detrimental to the proper completion of the Work. Do not proceed with work until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Remove dust, dirt, oils, loose or foreign matter which might impair adhesion of materials.

B. Masonry walls shall have mortar joints struck flush. All voids and holes, particularly in the mortar joints, shall be filled with lean mortar mix, non-shrink grout or parge coat.

C. Exterior sheathing substrates shall be sufficiently stabilized with corners and edges fastened with appropriate fasteners. Prepare joints, changes in substrate plane, and corners in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.

C. Self-Adhered Sheet Membrane:
1. Prepare substrate in manner recommended by coating manufacturer; treat joints in substrate and between dissimilar materials as recommended by manufacturer.
2. Prime substrate surfaces to receive weather barrier membrane in accordance with manufacturer's instructions. Apply primer to substrates to receive membrane at required rate and allow to dry. Limit priming to areas that will be covered in same day. Re-prime areas exposed for duration permitted by the manufacturer.
3. Install sheets in horizontal rows, weather lapping joints a minimum of 2 inches. Offset seams at adjacent rows by a minimum of 12 inches. Wipe dust or debris from film side of sheet with a clean, dry cloth to assist in forming tight laps. Avoid forming wrinkles and air pockets (Special attention at all transitions and corners to avoid fish mouthing of corners). Press sheet firmly to substrate with a hand roller, especially at laps, corners and terminations. Use narrower cut sizes for detailing. Sequence the installation to provide shingled laps. Membrane shall bear minimum 3" onto each side of transitions such as joints, angle changes and substrate changes. Membrane shall bear 6 inches minimum onto adjacent membrane systems such as foundation waterproofing or roofing. Apply lap sealant to non-water-shedding laps and terminations.
4. Transition flashing shall be used to detail window openings and wall transitions. Treat joints in substrate and between dissimilar materials as recommended by the system manufacturer.
5. Membrane flashing shall be kept back a minimum of 1/2 inch from finished exterior.
6. Brick ties shall be installed after sheet membrane has been installed. Fasteners shall be straight and not over driven. All holes from mis-driven fasteners shall be sealed.
7. At expansion joints, follow manufacturer's installation guidelines and install a backer rod to create an expansion bulb, prime and install expansion joint membrane flashing as recommended by the manufacturer.
8. Roof Tie-ins: Extend weather barrier system to termination point at roof edge or parapet blocking as detailed to create a continuous building air barrier. Transition membrane shall lap over blocking to tie into roof sheet vapor retarder an be secured and sealed in accordance with manufacturer's recommended details. See Section 07 53 00.
9. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface in accordance with manufacturer's recommendations.

D. Openings and Penetrations in Weather Barrier:
1. Transition Membrane: Apply transition membrane as indicated per the Drawings at door, storefront, curtainwall, louver and window framing perimeters, roof and floor intersections,

other trade penetrations, and changes in substrate. Use pre-cut, easily handled lengths for each location.

2. Membrane Flashing: Locate at heads of openings, items that bridge the cavity and other locations as indicated on the Drawings. Fully adhere flashing to substrate to prevent water from migrating under the flashing and seal top edge with termination mastic.
    a. Remove release paper and position membrane flashing carefully before placing it against the surface. When properly positioned, place against surface by pressing firmly into place by hand roller. Overlap adjacent pieces 2 inches and roll all seams with a hand roller. Seal to edge of flashing with termination mastic.
    b. Trim bottom edge 1/2 inch back from exposed face of the exterior wall. Flashing shall not be permanently exposed to sunlight. Flashing shall be adhered to top surface of metal flashing drip edge that shall project beyond face of exterior wall.
    c. At heads, sills and all flashing terminations, turn up ends a minimum of 2 inches and make careful folds to form an end dam, with the seams sealed.
    d. At openings to be filled with non-flanged frames, seal weather barrier to all sides of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.
    e. Do NOT allow the rubberized asphalt surface of the flashing membrane to come in contact with polysulfide sealants, creosote, uncured coat tar products, TPO or EPDM.
3. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.
4. Treat construction joints and install flashing as recommended by manufacturer.

3.04 WASTE MANAGEMENT AND DISPOSAL

A. Separate and recycle waste materials in accordance with the waste disposal plan. See Section 01 74 19. Place materials defined as hazardous or toxic waste in designated containers. Ensure emptied containers are stored safely for disposal.

3.05 FIELD QUALITY CONTROL

A. Obtain approval of installation procedures by the weather barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.

B. Contractor's Responsibilities: The Contractor shall appoint one individual who shall be responsible for achieving an acceptable, water and air barrier installation. This individual shall be on-site throughout the installation of the weather barrier and shall observe sealing of all penetrations, door, window, curtain wall, storefront, other openings, and sealing of weather barrier to roof air-vapor barrier to help ensure a proper installation.

C. Weather barrier shall not be concealed until the installation has been accepted by the Owner, Architect, and manufacturer’s field representative.

3.06 PROTECTION AND CLEANING

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

B. Remove any masking materials after installation. Clean any stains on materials that would be exposed in the completed work using procedures as recommended by the manufacturer.

C. Protect membranes to avoid damage from other trades, and construction materials during subsequent operations.

D. Schedule work to ensure that the weather barrier is covered as soon as possible after installation. Protect the installation from damage during subsequent operations. If the installation cannot be covered within 30 days after installation, apply temporary UV protection such as dark plastic sheet or tarpaulins.

END OF SECTION

SECTION 07 42 64
METAL COMPOSITE MATERIAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior cladding consisting of formed metal composite material (MCM) sheet, secondary supports, and anchors to structure, attached to solid backup.

B. Matching flashing and trim.

C. Wall cladding support system.

1.02 RELATED REQUIREMENTS

A. Section 07 21 00 - Thermal Insulation: Rigid cavity insulation and wall cladding support system for support of MCM wall panels.

B. Section 07 25 00 - Weather Barriers: Water-resistive barrier behind wall panel system.

C. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashing components integrated with this wall system.

D. Section 07 90 ~~05~~ - Joint Sealants: Sealing joints between siding and adjacent construction and fixtures.

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

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

B. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2023b.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

D. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2023.

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

F. ASTM D1781 - Standard Test Method for Climbing Drum Peel for Adhesives; 1998 (Reapproved 2021).

G. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics; 2023.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

I. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

J. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

K. NFPA 285-19 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2019.

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 at least three weeks before starting work of this section to verify project requirements, co-ordinate with installers of other work, establish condition and completeness of building substrate, and review manufacturers' installation instructions and warranty requirements.
   1. Require attendance by the installer and relevant sub-contractors.
   2. Review procedures for protection of work and other construction.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data - MCM Sheets: Manufacturer's data sheets on each product to be used, including thickness, physical characteristics, and finish, and:
   1. Finish manufacturer's data sheet showing physical and performance characteristics.
   2. Storage and handling requirements and recommendations.
   3. Fabrication instructions and recommendations.
   4. Specimen warranty for finish, as specified herein.

C. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:
   1. Physical characteristics of components shown on shop drawings.
   2. Storage and handling requirements and recommendations.
   3. Installation instructions and recommendations.
   4. Specimen warranty for wall system, as specified herein.

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: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, support clips, exposed fasteners, number of anchors, supports, reinforcement, trim, flashings, and accessories.
   1. Indicate deflection joint details in coordination with wall cladding support system. Provide slip connections to provide deflection of MCM system.
   2. Indicate panel numbering system.
   3. Differentiate between shop and field fabrication.
   4. Indicate substrates and adjacent work with which the wall system must be coordinated.
   5. Include large-scale details of anchorages and connecting elements.
   6. Include large-scale details or schematic, exploded or isometric diagrams to fully explain flashing at a scale of not less than 1-1/2 inches per 12 inches.
   7. Include design engineer's stamp or seal on shop drawings for attachments and anchors.

F. Load Calculations: Submit metal composite material wall panel system manufacturer’s comprehensive analysis of design loads, including dead loads, live loads, wind loads and thermal movement, signed and sealed by a licensed engineer in the State in which the Project is located. Provide these calculations to subcontractors for use in preparation of engineered shop drawings for the Wall Cladding Support System as specified in this Section and the Cold Formed Metal wall framing as specified in Section 05 40 00.
   1. In conjunction with the submittals required here-in, submit a record copy statement by the structural engineer employed by the Wall Cladding Support System subcontractor per this Section and the CFMF subcontractor per Section 05 40 00. Statement shall confirm structural calculations pertaining to the design requirements of the metal framing member

and MCM panels engineered per this Section have been received, and that the design of supporting Wall Cladding Support System and CFMF systems meet the design requirements and applicable code for the system as a whole.

G. Wall Cladding Support Submittals:
   1. Wall Cladding Support System Shop Drawings: Submit engineered shop drawings indicating girt system components, girt spacing and locations for wall cladding materior interface with building framing, dimensions, locations and types of fasteners, anchorage, opening details, design loading, and accessories. All shop drawings and calculations shall bear the seal of a licensed structural engineer employed by the wall panel subcontractor, licensed in the jurisdictional area of the project.
   2. Wall Cladding Support System Test and Engineering Reports: Submit Test and Engineering reports on each type of composite sub-framing system based on the evaluation of comprehensive tests performed by a certified testing agency and/or Professional Engineers (PE) approved by authorities having jurisdiction.
      a. Structural Composite Sub-Framing Submittal:
         1) Provide PE stamped calculations for the composite sub-framing system carrying the associated cladding system that takes into account:
            (a) Anisotropic properties of the sub-framing.
            (b) Point loading of the fasteners and representative dynamics of the cladding system.
            (c) Uniform loading calculations not being allowed as it is not representative to actual wall systems.
            (d) Calculations for eccentric cantilever conditions.
            (e) Fastener Design Criteria: Minimum safety factor of four for both tension and shear values.
            (f) Fastener Creep and Durability Test for FRP sub-girts, certified by third party/PE.
            (g) Thermal Movement Design Criteria: Cladding systems allow for thermal movements without overstressing components and evidence of permanent component defects, based on maximum ambient temperature of 120 degrees F.
            (h) Fire: ASTM E84 Class A and NFPA 285-19 tested for the specific wall assembly in this project.
            (i) All test data shall be with in the past seven (7) years.
      b. In conjunction with shops required here-in, submit a record copy statement by the structural engineer employed by the CFMF subcontractor per Section 05 40 00. Statement shall confirm structural calculations pertaining to the design requirements of the cladding support system engineered per this Section have been received, and that the design of supporting CFMF systems meet the design requirements and applicable code as applicable.

H. Verification Samples: For each finish product specified, submit at least three samples, minimum size 12 inch square, and representing actual product in color and texture.

I. Design Data: Submit structural calculations stamped by design engineer, for Architect's information and project record.

J. Test Report: Submit report of full-size mock-up tests for air infiltration, water penetration, and wind performance.

K. Test Report: Submit Evalulation 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.

L. Fire Engineer's Report: Submit Evaluation report from licensed fire engineer indicating that the shop drawings have been reviewed and all wall components were evaluated and comply with IBC 2021 and NFPA 285-19.

M. Maintenance Data: Care of finishes and warranty requirements.

N. Warranty Documentation for Installation of Building Rainscreen Assembly: Submit installer warranty and ensure that forms have been completed in Owner's name and registered with installer.

1.07 QUALITY ASSURANCE

A. Field Measurements: Verify actual dimensions by field measurement before fabrication; show recorded measurements on shop drawings.

B. Design Engineer's Qualifications: Design structural supports and anchorages under direct supervision of a Structural Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
   1. Wall Cladding support system, in its entirety will be reviewed by the MCM cladding manufacturer and coordinated with the structural engineer employed by the CFMF subcontractor per Section 05 40 00.

C. Wall System Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section.
   1. With not less than five years of documented experience.

D. Installer Qualifications: Company specializing in performing work of the type specified in this Section.
   1. With minimum five years of documented experience.
   2. Approved by wall panel system manufacturer.

1.08 MOCK-UPS

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

B. Provide a mock-up for evaluation of fabrication workmanship.

C. Locate where directed.

D. Provide specified finish on panels.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
   1. Protect finishes by applying heavy-duty removable plastic film during production.
   2. Package for protection against transportation damage.
   3. Provide markings to identify components consistently with drawings.
   4. Exercise care in unloading, storing, and installing panels to prevent bending, warping, twisting, and surface damage.

B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
   1. Store in well-ventilated space out of direct sunlight.
   2. Protect from moisture and condensation with tarpaulins or other suitable weathertight covering installed to provide ventilation.
   3. Store at a slope to ensure positive drainage of accumulated water.
   4. Do not store in enclosed space where ambient temperature can exceed 120 degrees F.
   5. Avoid contact with other materials that might cause staining, denting, or other surface damage.

1.10 FIELD CONDITIONS

A. Do not install panels when air temperature or relative humidity are outside manufacturer's limits.

1.11 WARRANTY

A. See Section 01 78 10 - Warranties for additional warranty requirements.

B. Finish Warranty: Provide 5-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Composite Material (MCM) Sheet Basis of Design Manufacturer:
   1. ALUCOBOND by 3A Composites USA; ALUCOBOND PLUS, Route & Return (Fire Retardant core).

B. Other Acceptable Manufacturers:
   1. ALPOLIC Materials; ALPOLIC/fr (Fire Retardant core).
   2. Substitutions: See Section01 60 00-Product Requirements.

2.02 WALL PANEL SYSTEM

A. Wall Panel System: Metal panels, fasteners, and anchors designed to be supported by framing or other substrate provided by others; provide installed panel system capable of maintaining specified performance without defects, damage, or failure.
   1. Provide structural design by or under direct supervision of a Structural Engineer licensed in the State in which the Project is located.
   2. Provide panel jointing and weatherseal using reveal joints and gaskets but no sealant.
   3. Anchor panels to supporting framing without exposed fasteners.

2.03 PERFORMANCE REQUIREMENTS

A. Thermal Movement: Provide for free and noiseless vertical and horizontal thermal movement due to expansion and contraction under material temperature range of minus 20 degrees F to 180 degrees F without buckling, opening of joints, undue stress on fasteners, or other detrimental effects; allow for ambient temperature at time of fabrication, assembly, and erection procedures.

B. Wind Performance: Provide system tested in accordance with ASTM E330/E330M without permanent deformation or failures of structural members under the following conditions:
   1. Designed to withstand wind loads calculated with ASCE 7 and as indicated on Structural Drawings.
   2. Maximum deflection of perimeter framing member of L/175 normal to plane of the wall; maximum deflection of individual panels of L/60.
   3. Maximum anchor deflection in any direction of 1/16 inch at connection points of framing members to anchors.

C. Fire Performance: Use test method complying with NFPA 285-19.

D. Fabricate the panel system so that no restraints can be placed on panels that might result in compressive skin stresses. The installation detailing shall be such that the panels remain flat regardless of temperature change and at all times remain air and watertight.

2.04 PANELS

A. Panels: Pans formed of metal composite material sheet by routing back edges of sheet, removing corners, and folding edges.
   1. Reinforce corners with riveted aluminum angles.

2. Provide concealed attachment to supporting structure by adhering attachment members to back of panel; attachment members may also function as stiffeners.
3. Maintain maximum panel bow of 0.8 percent of panel dimension in width and length; provide stiffeners of sufficient size and strength to maintain panel flatness without showing local stresses or read-through on panel face.
4. Secure members to back face of panels using structural silicone sealant approved by MCM sheet manufacturer.
5. Metallic Finished Panels: Maintain consistent grain of MCM sheet; specifically, do not rotate sheet purely to avoid waste.
6. Fabricate panels under controlled shop conditions.

B. Where final dimensions cannot be established by field measurement before commencement of manufacturing, make allowance for field adjustments without requiring field fabrication of panels.

C. Fabricate as indicated on drawings and as recommended by MCM sheet manufacturer.
1. Make panel lines, breaks, curves, and angles sharp and true.
2. Keep plane surfaces free from warp or buckle.
3. Keep panel surfaces free of scratches or marks caused during fabrication.

D. Provide joint details providing a watertight and structurally sound wall panel system that allows no uncontrolled water penetration on inside face of panel system.

E. For "dry" jointing, secure extrusions to returned pan edges with stainless steel rivets; provide means of concealed drainage with baffles and weeps for water that might accumulate in members of system.

2.05 MATERIALS

A. Metal Composite Material (MCM) Sheet: Two sheets of aluminum sandwiching a core of extruded thermoplastic material; no foamed insulation material content.
1. Overall Sheet Thickness: 0.118 inch, minimum.
2. Bond and Peel Strength: No adhesive failure of the bond between the core and the skin nor cohesive failure of the core itself below 22.4 inch-pound/inch with no degradation in bond performance, when tested in accordance with ASTM D1781, simulating resistance to panel delamination, after 8 hours of submersion in boiling water and after 21 days of immersion in water at 70 degrees F.
3. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
4. Flammability: Self-ignition temperature of 650 degrees F or greater when tested in accordance with ASTM D1929.

B. Metal Framing Members: Include sub-girts, zee-clips, base and sill angles and channels, hat-shaped and rigid channels, and furring channels required for complete installation.
1. Provide material strength, dimensions, configuration as required to meet applied loads and in compliance with applicable building code.
2. Sheet Steel Components: ASTM A653 galvanized to G90/Z275 or zinc-iron alloy-coated to A60/ZF180; or ASTM A792 aluminum-zinc coated to AZ60/AZM180.
3. Stainless Steel Sheet Components: ASTM A480.

2.06 FINISHES

A. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, with at least 80 percent of coil coated metal surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch; color and gloss as selected by Architect from manufacturer’s standard line.

B. Color: As selected by Architect.

2.07 ACCESSORIES

A. Flashing: Sheet aluminum; 0.040 inch thick, minimum; finish and color to match MCM sheet; see Section 07 62 00 for additional requirements.

B. Fasteners:
   1. Exposed Fasteners: Stainless steel; permitted only where absolutely unavoidable and subject to prior approval of the Architect.
   2. Screws: Self-drilling or self-tapping Type 410 stainless steel or zinc-alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal wall panels.
   3. Bolts: Stainless steel.
   4. Fasteners for Flashing and Trim: Blind fasteners of high-strength aluminum or stainless steel.

C. Joint Sealer: Provide color to match wall panels silicone sealant of type approved by MCM sheet manufacturer, and in compliance with ASTM C920.
   1. See Section 07 92 00 for additional requirements.

D. Provide panel system manufacturer's and installer's standard corrosion resistant accessories, including fasteners, clips, anchorage devices, and attachments.

2.08 CLADDING SUPPORT SYSTEM

A. Cladding Support System: Continuous thermal Z-girts, Fiberglass reinforced plastic (FRP) girts.
   1. Depth: As required for thickness of insulation.
   2. Spacing: As indicated on drawings, horizontally.
   3. Fasteners: As recommended by girt manufacturer.
   4. Orientation: Horizontal, other orientation as required for siding attachement.
   5. Rail Spacing: As required by Contractor-provided delegated design.
   6. Structural Performance: As required in submittal requirements of this Section.
   7. Products:
      a. Advanced Architectural Products, LLC; GREENGirt CMH System.
      b. Strongwell; Strongirt.
      c. Armatherm; Z Girt Structural Thermal Break.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine dimensions, tolerances, and interfaces with other work.

B. Examine substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturer's written instructions.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

D. Notify Architect in writing of conditions detrimental to proper and timely completion of work, and do not proceed with erection until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protect adjacent work areas and finish surfaces from damage during installation.

3.03 CLADDING SUPPORT INSTALLATION

A. Install cladding support systems in accordance with Contractor-provided structural design.

B. Installation of Wall Fasteners in Cold-Formed Metal Framing Wall Substrates: Install fasteners in accordance with Contractor-provided structural design.

3.04 INSTALLATION

A. Do not install products that are defective, including warped, bowed, dented, and broken members, and members with damaged finishes.

B. Comply with instructions and recommendations of MCM sheet manufacturer and wall system manufacturer, as well as with approved shop drawings.

C. Install wall system securely allowing for necessary thermal and structural movement; comply with wall system manufacturer's instructions for installation of concealed fasteners.

D. Do not handle or tool products during erection in manner that damages finish, decreases strength, or results in visual imperfection or failure in performance. Return component parts that require alteration to shop for refabrication, if possible, or for replacement with new parts.

E. Do not form panels in field unless required by wall system manufacturer and approved by the Architect; comply with MCM sheet manufacturer's instructions and recommendations for field forming.

F. Separate dissimilar metals; use gasket fasteners, isolation shims, or isolation tape where needed to eliminate possibility of electrolytic action between metals.

G. Install flashings as indicated on shop drawings. At flashing butt joints, provide a lap strap under flashing and seal lapped surfaces with a full bed of non-hardening sealant.

H. Install square, plumb, straight, and true, accurately fitted, with tight joints and intersections maintaining the following installation tolerances:
   1. Variation From Plane or Location: 1/2 inch in 30 feet of length and up to 3/4 inch in 300 feet, maximum.
   2. Deviation of Vertical Member From True Line: 0.1 inch in 25 feet run, maximum.
   3. Deviation of Horizontal Member From True Line: 0.1 inch in 25 feet run, maximum.
   4. Offset From True Alignment Between Two Adjacent Members Abutting End To End, In Line: 0.03 inch, maximum.

I. Replace damaged products.
   1. Exception: Field repairs of minor damage to finishes are permitted only when approved in writing by Architect, panel manufacturer, and fabricator.
   2. Field Repairs to Finishes: Using materials and methods sufficient that repairs are not discernible when viewed at distance of 10 feet under all typical light conditions experienced at the project.

3.05 CLEANING

A. Ensure weep holes and drainage channels are unobstructed and free of dirt and sealants.

B. Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work.

C. Remove temporary coverings and protection of adjacent work areas.

D. Clean installed products in accordance with manufacturer's instructions.

3.06 PROTECTION

A. Protect installed panel system from damage until Date of Substantial Completion.

END OF SECTION

SECTION 07 53 00
ELASTOMERIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Elastomeric roofing membrane, fully-adhered application.

B. Insulation, flat and tapered.

C. Roof air-vapor barrier.

D. Deck sheathing and cover boards.

E. Roofing stack boots, flashings, walkway pads and other roofing-related items specified or indicated on the drawings or otherwise necessary to provide a complete weatherproof roofing system.

F. Prefabricated Metal roof edges, coping, and scuppers.

1.02 RELATED REQUIREMENTS

A. Section 06 10 54 – Wood Blocking and Curbing: Wood blocking, nailers and curbs.

B. Section 07 62 00 - Sheet Metal Flashing and Trim: Miscellaneous flashing, prefabricated expansion joint covers.

C. Section 07 72 00 – Roof Accessories: Roof hatch and safety railing.

D. Division 22 - Plumbing: Roof drains.

E. Division 23 - HVAC: Mechanical equipment penetrating the roofing.

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

1.03 REFERENCE STANDARDS

A. 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).

B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023a.

D. ASTM D1079 - Standard Terminology Relating to Roofing and Waterproofing; 2020.

E. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics; 2016 (Reapproved 2023).

F. ASTM D1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics; 2020.

G. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.

H. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

I. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2015, with Editorial Revision (2022).

J. ASTM D4811/D4811M - Standard Specification for Nonvulcanized (Uncured) Rubber Sheet Used as Roof Flashing; 2016 (Reapproved 2023).

K. ASTM D5147/D5147M - Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material; 2018.

L. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

M. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

N. FM 4470 - Examination Standard for Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction; 2022.

O. FM (AG) - FM Approval Guide; Current Edition.

P. FM DS 1-28 - Wind Design; 2015, with Editorial Revision (2024).

Q. FM DS 1-29 - Roof Deck Securement and Above-Deck Roof Components; 2016, with Editorial Revision (2022).

R. NRCA (RM) - The NRCA Roofing Manual; 2024.

S. PS 1 - Structural Plywood; 2023.

T. PS 20 - American Softwood Lumber Standard; 2025.

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 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.
   3. Coordinate installation with adjacent metal roof.

A. Pre-installation Meeting: After the submission and review of roofing and flashing shop drawings, samples and printed data, convene a pre-installation meeting at least two weeks before starting installation. 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, coordination of scope of work under separate contract and other relevant issues.
   1. The following personnel shall be present:
      a. Contractor (Project Manager, Superintendent)
      b. Roofing Sub-Contractor (Project Manager, Foreman)
      c. Roofing and Flashing Materials Manufacturers' Technical Employees
      d. Mechanical Sub-Contractor (Project Manager, Foreman)
      e. Architect.
   2. Verify compatibility of all materials in contact with roofing, including but not limited to:
      a. Treated and Kiln-dry lumber.
      b. Sealants and adhesives.
      c. Insulations and roofing boards.
      d. Vapor Retarders.
      e. Sheathing.
      f. Thru wall flashing
      g. Walkway pads.
      h. All other roofing materials.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating membrane materials, insulation, vapor retarder, flashing and fasteners.
   1. Provide membrane manufacturer's printed data showing roofing system components comply with specified requirements and with membrane manufacturer's requirements and recommendations for system type specified; include data for each product used in conjunction with roofing membrane, including insulation and fasteners.
   2. Provide documentation showing roofing system is UL classified or FM approved where UL or FM requirements are specified; include data itemizing classified or approved system components.

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: Provide roofing details and roof layout plan.
   1. Indicate joint or termination detail conditions, conditions of interface with other materials, setting plan for tapered insulation, and paver layout.
   2. Indicate areas, slopes and thicknesses of tapered insulation on roof layout plan. Key-in details on roof layout plan.
   3. Indicate roof mounted equipment, hatches, etc.
   4. Indicate thickness and dimensions of all parts, fastening and anchoring methods, details and locations of seams, joints, and provisions necessary for thermal expansion and contraction. Key in details on roof layout plan.
   5. Indicate details of roof flashing including jointing, expansion joints, intersections with walls, terminations, transitions from cants to walls, transitions from curbs, fascia details, and any other details required for a complete watertight installation. Key in details on roof layout plan.

E. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.

F. Manufacturer’s Assembly Letter: Certify that roofing assembly meets manufacturer warranty code requirements and FM Global requirements, including edge metal approval.

G. Manufacturer's Certificate: Certify that all products, including insulation, underlayment and related fasteners are satisfactory for their intended applications..
   1. Submit final shop drawings to the roofing manufacturer for review as required by warranty requirements.

H. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, supplementary instructions given, and manufacturer acceptance substrate surface is ready and acceptable to receive roof system.

I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

J. Pre-Installation Notice: Submit a copy of the roofing manufacturer's required Pre-Installation Notice indicating acceptance and approval by the roofing manufacturer.

J. Executed warranty.

K. Specimen Warranty: Submit before starting work.

1.07 QUALITY ASSURANCE

A. Perform work in accordance with NRCA Roofing and Waterproofing Manual and manufacturer's instructions.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum twenty years of documented experience.

C. Installer Qualifications: Company specializing in performing the work of this Section with minimum ten years documented experience, and approved by manufacturer.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.

B. Store products in weather protected environment, clear of ground and moisture.

C. Protect foam insulation from direct exposure to sunlight.

D. Materials being stored on a roof surface shall not overload the deck or structural assembly.

E. Lids shall be secured on cans of stored materials and all emulsions, coatings, adhesives, solvents, sealants, foams, etc. shall be stored at temperatures as recommended by the manufacturers.

1.09 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.

B. Do not apply roofing membrane when ambient temperature is below 40 degrees F or above manufacturer's recommendations degrees F.

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.

1.10 WARRANTY

A. See Section 01 78 10 - Warranties.

B. Applicator/Contractor Warranty: The roofing and flashing subcontractor hereby guarantees that roofing, roof insulation, roof accessories, flashings and roof metalwork will 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 and flashing 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 System and Membrane Warranties: Upon completion of the membrane roofing system work, the roofing materials manufacturer shall furnish the Owner a "Total System" / "Red Shield" warranty covering membrane, insulation, roof metalwork, and membrane accessories, insuring a watertight roof for a period of Twenty-Five (25) years. The warranty shall cover repairing leaks due to ordinary wear and tear of the elements, manufacturing defects and defective workmanship, wind damage up to 72 mph, over the Twenty-Five (25) year period; no dollar limitation for liability.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. EPDM Membrane Materials Basis of Design Manufacturer:
   1. Holcim Elevate.
   2. Acceptable Substitute Manufacturers:
      a. Carlisle Syn Tec.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: Manufacturer as recommended by the roofing system manufacturer.

C. Fasteners, polymeric components, edgings, accessories and components required to complete the specified system: The roofing system membrane or accepted by the roofing system manufacturer as compatible.

2.02 ROOFING SYSTEM DESCRIPTION

A. Description: EPDM single-ply membrane.

1. Membrane Attachment: Fully adhered.
2. Deck Slope: As indicated on Drawings; provide slope of 1/4 inch per foot by means of tapered insulation where deck is flat.
3. Provide roofing system to withstand wind speed in accordance with local building code and authorities having jurisdiction (AHJ).
4. Provide assembly having Underwriters Laboratories, Inc. (UL) Class C fire hazard classification.
5. Provide assembly complying with Factory Mutual Corporation (FM) Roof Assembly Classification, FM DS 1-28 and FM DS 1-29, and meeting minimum requirements of FM 1-90 wind uplift rating.

B. Components, from Top of Roof Down:
1. Membrane: Thickness as specified below.
2. Cover Board: High-density polyisocyanurate; 1/2 inch thick; adhered.
3. Insulation:
   a. Maximum Board Thickness: 2 inches; use as many layers as necessary; stagger joints in adjacent layers.
   b. Tapered: Minimum slope as indicated on drawings; provide minimum R-value at thinnest point; place tapered layer on top.
   c. Total System R-value: 34, minimum. Not less than 6” of polyisocyanurate board insulation.
   d. Top Layer: Polyisocyanurate foam board, noncomposite; cold adhesive attached.
   e. Intermediate Layer: Polyisocyanurate foam board, noncomposite; cold adhesive attached.
   f. Bottom Layer: Polyisocyanurate foam board, noncomposite; mechanically fastened.
   g. 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: Glass-mat faced gypsum board, adhered, 1/2 inch thickness or 1/4 inch if deck flute span permits.

B. Roofing Assembly Requirements:
1. Basic Wind Speed, Importance Factor, Exposure: See Structural.
2. Roof Covering External Fire Resistance Classification: UL Class C.

2.03 ROOFING MEMBRANE AND ASSOCIATED MATERIALS

A. Roofing Membrane: Cured synthetic single-ply membrane composed of EPDM with the following properties:
1. Reinforcement: None; membrane complying with ASTM D4637/D4637M, Type I.
2. Membrane and Flashing Color: Black.
3. Thickness: 60 mils, 0.06 inch
4. Nominal Thickness Tolerance: Plus/minus 10 percent.
5. Sheet Width: Provide widest available sheets to minimize field seaming.
6. Products:
   a. Elevate; RubberGard Platinum EPDM Membrane.

B. Flashing Membrane: Self-curing, non-reinforced membrane composed of nonvulcanized EPDM rubber, complying with ASTM D 4811 Type II, and with the following properties:
1. Thickness: 0.055 inch (1.4 mm).
2. Acceptable Product: RubberGard EPDM FormFlash by Elevate.
3. Pre-Molded Pipe Flashings: EPDM, molded for quick adaptation to different sized pipes; Holcim Elevate EPDM Pipe Flashing.

C. Self-Adhesive Lap Splice Tape: 35 mil EPDM based, formulated for compatibility with EPDM membrane and high-solids primer.

1. Product: Elevate; QuickSeam Splice Tape.
2. Splice Adhesive: Synthetic polymer-based, formulated for compatibility with EPDM membrane and metal surfaces; SA-1065 Splice Adhesive by Holcim Elevate.

D. Bonding Adhesive: Acrylic-based, water-borne, formulated for compatibility with EPDM membrane and wide variety of substrate materials, including masonry, wood, and insulation facings; Water-Based Bonding Adhesive by Holcim Elevate.

E. Adhesive Primer: Synthetic rubber-based primer formulated for compatibility with EPDM membrane and tape adhesive, with VOC content less than 2.1 lb/gal (250 g/L); QuickPrime Plus LVOC by Holcim Elevate.

F. Seam Edge Treatment: EPDM rubber-based sealant, formulated for sealing exposed edges of membrane at seams; Lap Sealant HS by Holcim Elevate.

G. Pourable Sealer: Two-part polyurethane, two-color for reliable mixing; Pourable Sealer by Holcim Elevate.
1. All roof penetrations by pipe and conduit to be pre-molded flashing. For conduit or other items where pre-molded flashing isn't a manufacturer option, provide piped gooseneck sealed with pre-molded flashing. Use pourable sealant where no other options are available.

H. Water Block Seal: Butyl rubber sealant for use between two surfaces, not exposed; Water Block Seal by Holcim Elevate.

I. Metal Plates and Strips Used for Fastening Membrane and Insulation and Transition between roofing membrane and weather resistive barriers or transistion membrane provided in Section 07 25 00: Steel with Galvalume coating; corrosion-resistance meeting FM 4470 criteria.

J. Termination Bars: Aluminum bars with integral caulk ledge; 1.3 inches (33 mm) wide by 0.10 inch (2.5 mm) thick; Holcim Elevate Termination Bar by Holcim Elevate.

K. Roof Walkway Pads: EPDM, 0.30 inch (7.6 mm) thick by 30 by 30 inches (760 by 760 mm) with EPDM tape adhesive strips laminated to the bottom; QuickSeam Walkway Pads by Holcim Elevate.
1. Applications:
   a. Plan layouts as indicated per the Drawings.
   b. Top and bottom of each roof access ladder indicated, 4' x 4' area, whether indicated or not on the Drawings.
   c. Below non-penetrating rooftop safety railings.

L. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.

O. Roof Sheet Vapor Retarder: 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.

M. Insulation Cover Board: Water-resistant, high-density, closed-cell polyisocyanurate core with coated glass mat facers complying with ASTM C1289, Type II, Class 4 and the following characteristics:

1. Thermal Value: R-value of 2.5, when tested in accordance with ASTM C518 and ASTM C177.
2. Surface Water Absorption by Volume: 3 percent, maximum, when tested in accordance with ASTM C209.
3. Compressive Strength: Grade 1, 120 psi, when tested in accordance with ASTM D1621.
4. Density: 5 pcf, when tested in accordance with ASTM D1622.
5. Mold Growth Resistance: Zero growth, when tested in accordance with ASTM D3273 for minimum of four weeks.
6. Product: Elevate; ISOGARD HD Cover Board.

N. Deck Sheathing: 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. Spanning Capability: Recommended by manufacturer for following minimum flute spans:
3. Sheathing Thickness 1/2-inch: Flute span 5 inches, minimum.
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. Factory Mutual approved for use with FM 1-60 and 1-90 rated roofing assemblies.
7. Mold Growth Resistance: Zero growth, when tested in accordance with ASTM D3273 for minimum of four weeks.
8. Products:
   a. Georgia-Pacific; DensDeck.
   b. USG; Securock UltraLight Glass-Mat Roof Board.

2.04 INSULATION

A. Roof Rigid Insulation Board : Closed-cell polyisocyanurate foam laminated to facers, complying with ASTM C1289, Type II, Class 1, with the following additional characteristics:
1. Compressive Strength: 20 psi when tested in accordance with ASTM D1621.
2. Ozone Depletion Potential: Zero; made without CFC- or HCFC-blowing agents.
3. Mold Growth Resistance: Zero growth, when tested in accordance with ASTM D3273 for minimum of four weeks.
4. Tapered Board: Slope as indicated; fabricate of fewest layers possible.
5. Product:
   a. Elevate; ISOGARD GL Polyisocyanurate Insulation.

B. Insulation Fasteners: Type and size as required by roof membrane manufacturer for roofing system and warranty; use only fasteners furnished by roof membrane manufacturer.

C. Adhesive for Insulation Attachment: Type as required by roof membrane manufacturer for roofing system and warranty; use only adhesives furnished by roof membrane manufacturer.

2.05 METAL ROOF EDGES AND SCUPPERS

A. Aluminum Coping: Manufactured coping system consisting of metal coping cap in section lengths not exceeding 12 feet , concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.
1. Approvals: ANSI/SPRI/FM 4435/ES-1 and complies with manufacturer warranty requirements.
   a. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test methods RE-1 and RE-2 to positive and negative design wind pressure as defined by applicable local building code.
2. Finish Material:
   a. Pre-Finished Aluminum: ASTM B209; 0.050 inch thickness or as otherwise indicated; plain finish shop pre-coated with fluoropolymer coating.

1) Fluoropolymer Coating: Superior Performing Organic Coatings, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; Kynar or Duranar by PPG.
2) Color: As selected by architect from manufacturers standard colors.

3. Corners: Prefabricated mitered units.
4. Accessories: Provide manufacturer prefabricated scuppers compatible with manufacturer's coping.
   a. Projection:
5. Coping-Cap Attachment Method: Snap on with extruded aluminum anchor bar and/or 20 ga. Galvanized steel continuous cleat.
6. Fascia Heights:
   a. Exterior: 5 inches.
   b. Interior:
7. Products:
   a. Alum Coping: Elevate, Metal-Era; Perma-Tite Coping.
   b. Substitutions: See Section 01 60 00 - Product Requirements.

2.06 ACCESSORIES

A. Break Metal Plate: Continuous galvanized steel sheet metal strips for transition of sheet vapor retarder to roofing membrane.
   1. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch thick base metal.

B. Roof Expansion Joints: Manufacturer’s standard expansion joint detail using compressible tubes or composite construction of flexible EPDM flashing of black color with closed cell urethane foam backing, each edge seamed to aluminum sheet metal flanges with vapor barrier and insulation. Include special formed corners, tees, intersections, and wall flashings, each sealed watertight. All expansion joints to be provided with

C. Expansion Joint Insulation: Batt insulation encased in 45 mil reinforced EPDM membrane vapor barrier, for adhesive and mechanical fastening:
   1. R-Value: R-30.
   2. Joint Width: See Drawings.
   3. Product: Inpro; JL Series.
      a. Substitutions: See Section 01 60 00 - Product Requirements.

D. Compressible Tube: Product as recommended by roofing manufacturer for standard expansion joint detail.

E. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.

F. Sealants: One-part urethane as recommended by roofing membrane manufacturer.

G. Wood Nailers: See Section 06 10 54.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

F. Ensure that treated wood nailers are installed at the perimeter of each roof level, curb, expansion joint, and all roof penetrations as recommended by the membrane manufacturer. Nailers shall be firmly anchored to resist forces of not less than those prescribed by applicable codes and regulations. See Section 06 10 54 - Wood Blocking and Curbing for additional information. The thickness of the nailers shall be such that the top of the nailer is flush with the surface to which the membrane is attached at the horizontal plane. All preservative treated wood blocking shall be separated from all metals by use of membrane flashing, see Section 06 10 54.

G. Inspect the substrates scheduled to receive the roofing and flashing systems. Notify the Contractor of any and all defects in the substrates and do not proceed with the work until such defects have been satisfactorily corrected. Before beginning the Work, a representative of the membrane manufacturer shall examine the roof surfaces in order to ensure that they are acceptable for application.

H. Consult manufacturer for recommended procedures during cold weather. Do not work with sealants and adhesives when material temperature is outside the range of 60 to 80 degrees F (15 to 25 degrees C).

3.02 PREPARATION

A. Do not start work until preinstallation notice has been submitted to manufacturer.

B. Prior to proceeding, prepare roof surface so that it 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 the membrane.

C. Fill all surface voids in the immediate substrate that are greater than 1/4 inch (6 mm) wide with fill material acceptable insulation to membrane manufacturer.

D. Seal, grout, or tape deck joints, where needed, to prevent material seepage into building.

3.03 PREPARATION - METAL DECK

A. Install deck sheathing on metal deck.

B. Lay with long side at right angle to flutes; stagger end joints; provide support at ends.

C. Cut and install deck sheathing to provide smooth and flat surface.

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

E. Adhere deck sheathing to roof deck with continuous mopping of adhesive.

3.04 INSTALLATION - GENERAL

A. 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.

B. Obtain relevant instructions and maintain copies at project site for duration of installation period.

C. Provide temporary closures to ensure moisture does not damage completed roofing. Use flashings, terminations, and temporary closures to provide watertight installation.

3.04 VAPOR RETARDER AND ROOF INSULATION

A. Apply vapor retarder to deck sheathing surface with integral adhesive backing in accordance with manufacturer's instructions.
   1. Prime substrate in accordance with manufacturer instructions if required by manufacturer.
   2. Install flexible flashing from vapor retarder to air seal material of wall construction, lap and seal to provide continuity of the air barrier plane. Refer to the Drawings for additional information.

B. Ensure vapor retarder is clean and dry, continuous, and ready for application of insulation.

C. Install insulation in accordance with manufacturer's written instructions

D. 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.

E. Lay roof insulation in courses parallel to roof edges.

F. 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 acceptable insulation. Do not leave roofing membrane unsupported over space greater than 1/4 inch.

G. Attachment of Insulation: Mechanically fasten to deck in accordance with roofing manufacturer's instructions. Adhere insulation courses above base course with adhesive.

H. Lay subsequent layers of constant thickness insulation board with joints staggered minimum 6 inch from joints of preceding layer.

I. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.

J. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof. Fill gaps with acceptable insulation.

K. At roof drains, use factory-tapered boards to slope down to roof drains over a distance of 24 inches.

3.05 MEMBRANE APPLICATION – FULLY ADHERED

A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.

B. Shingle joints on sloped substrate in direction of drainage.

C. Membrane shall be fully-adhered except in areas directly over or within 3 inches of expansion joints. Overlap edges and seal seams in accordance with manufacturer's recommendations.

D. 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.

E. At intersections with vertical surfaces:
   1. Extend membrane flashing up a minimum of 12 inches onto vertical surfaces.
   2. Provide securement strips and fasten as recommended by the membrane manufacturer.

F. 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 in drawings, or as recommended by roofing manufacturer.

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

H. Metal Accessories: Install metal edgings, gravel stops, and copings in locations indicated on drawings, with horizontal leg of edge member over membrane, and flashing over metal onto membrane.
   1. Follow roofing manufacturer's instructions.
   2. Remove protective plastic surface film immediately before installation.
   3. Install water block sealant under membrane anchorage leg.
   4. Flash with manufacturer's recommended flashing sheet.
   5. Where single flashing application does not completely cover metal flange, install additional flashing piece to cover metal edge.
   6. If roof edge includes gravel stop and sealant is not applied between laps in metal edging, install additional piece of self-adhesive flashing membrane over metal lap to top of gravel stop; apply seam edge treatment at intersections of two flashing sections.

7. When roof slope is greater than 1 inch per foot, apply seam edge treatment along back edge of flashing.

I. 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 noted on drawings.
   2. Use longest practical flashing pieces.
   3. Evaluate substrate and overlay; 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.

J. Roof Drains:
   1. Taper insulation around drain to provide smooth transition from roof surface to drain. Use specified premanufactured tapered insulation with facer or suitable bonding surface to achieve slope; slope not to exceed manufacturer's recommendations.
   2. Position membrane, then cut hole for roof drain to allow 1/2 to 3/4 inch of membrane to extend inside clamping ring past drain bolts.
   3. Make round holes in membrane to align with clamping bolts; do not cut membrane back to bolt holes.
   4. Apply sealant on top of drain bowl where clamping ring seats below membrane.
   5. Install roof drain clamping ring and clamping bolts; tighten clamping bolts to achieve constant compression.

K. 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. Flexible Moving, and Single Conduit Penetrations: Provide weathertight gooseneck set in sealant and secured to deck, flashed as recommended by manufacturer.

L. Install walkways at access points to roof, around rooftop equipment requiring maintenance, and where indicated on drawings.

M. Do not install walkway pads within 10 feet of roof edge or perimeter.

N. 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.

O. 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.

3.06 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field quality control and inspection.

B. System Manufacturer's Inspection: Inspection(s) shall be made by a technical representative of the system manufacturer to ascertain that the roofing system has been installed in accordance with the system manufacturer's published specifications and details.
   1. The purpose of this inspection is to determine whether a system warranty will be issued by the system manufacturer. Should the technical representative find that the roofing system has not been installed in a manner that qualifies for issuance of the specified system warranty, the system shall not be acceptable to the Owner until the installer has made

corrections or repairs, the system has been re-inspected by the system manufacturer's technical representative and the specified roofing system warranty has been issued.

2. Submit a copy of all inspection reports and follow-up reports to the Architect.

3.07 CLEANING

A. Repair or replace defaced or damaged finishes caused by work of this Section.

B. Protect installed roofing and flashings from construction operations.

END OF SECTION

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings and miscellaneous brake metal.

B. Manufactured counterflashing and accessories.

C. Sealants for joints within sheet metal fabrications.

D. Metal roof to wall expansion joints.

1.02 RELATED REQUIREMENTS

A. Section 04 20 00 – Unit Masonry: Metal flashing embedded in masonry.

B. Section 06 10 54 - Wood Blocking and Curbing: Wood blocking for metal flashings.

C. Section 07 53 00 - Elastomeric Membrane Roofing: Membrane roofing system requiring metal work for Total System warranty. Prefabricated roof edge metal including fascias and copings.

D. Section 07 42 64 - Metal Composite Material Wall Panels: Color matching of flashing.

E. Section 07 72 00 - Roof Accessories: Roof-mounted accessories.

F. Section 07 95 13 – Expansion Joint Assemblies: Roof to wall metal expansion joint cover.

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

1.03 REFERENCE STANDARDS

A. AAMA 611 – Voluntary Specification for Anodized Architectural Aluminum; 2020.

B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

E. SMACNA - Architectural Sheet Metal Manual; 2012.

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 at least three weeks before starting work of this Section in conjunction with roofing pre-installation meeting. See Sections 07 53 00.

B. Pre-installation Meeting shall take place after submittals have been sent to Architect for review. Submittals will be returned after the meeting with comments from the meeting included.

C. Roof system manufacturer representative shall be present at the Pre-installation Meeting.

1.06 PERFORMANCE REQUIREMENTS

A. General: Install flashings that are watertight; will not permit the passage of liquid water; and will withstand wind loads, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.

1.07 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit product data for manufactured items including materials, finish, fastening methods, configurations and integration with adjacent materials.

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 material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details. Key into roof plan shop drawing, see Section 07 53 00 - Elastomeric Membrane Roofing.

E. Samples:
1. Submit samples each 4x4 inch in size, illustrating metal materials, thickness, and colors.
2. Submit samples 8" long in size, illustrating roofing fascia system.

1.08 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with ten years of documented experience.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

1.10 WARRANTY

A. The flashing and roofing subcontractor hereby guarantees that roof metalwork, flashings, roofing, roof insulation and roof accessories will 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 and flashing 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.

B. Metal Flashings Warranty under Roofing Manufacturer's Total System Warranty: See Section 07 53 00 – Elastomeric Membrane Roofing.

C. . Pre-finished Aluminum: Finish shall be warranted against premature failure for twenty years.

PART 2 PRODUCTS

2.01 MATERIALS

A. Pre-Finished Aluminum: ASTM B209; thickness as indicated in this Section; plain finish shop pre-coated with fluoropolymer coating or color anodized finish.
1. Superior Performing Organic Coatings System: Manufacturer's standard multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch.

B. Stainless Steel: ASTM A666, Type 304 alloy, soft temper, 28 gauge, 0.0156 inch thick; smooth No. 4 - Brushed finish.

2.02 FABRICATED PRODUCTS

A. Metal Expansion Joint – Roof/Wall:
1. Joint Cover Material:
a. Pre-Finished Aluminum: ASTM B209; 0.050 inch thickness or as otherwise indicated; plain finish shop pre-coated with fluoropolymer coating.

1) Fluoropolymer Coating: Superior Performing Organic Coatings, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; Kynar or Duranar by PPG.
2) Color: As selected by architect from manufacturers standard colors.

2. Formed Lengths: 12'-0" (3.65 m), with slotted fastening holes.
3. Concealed Splice Plates: At each joint, 8 inches (203 mm) wide.
4. Continuous Rail: 20-gauge (0.65-mm) galvanized steel.
5. Provide factory fabricated end caps and end walls.
6. Dimensions: See details and verify in field.
7. Product:
   a. Metal-Era Perma-Tite Expansion Joint.
   b. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACCESSORIES

A. Fasteners: Stainless steel.

B. Protective Backing Paint: Zinc molybdate alkyd.

C. Sealant to be Concealed in Completed Work: Non-curing butyl sealant.

D. Sealant to be Exposed in Completed Work: ASTM C920; elastomeric sealant, 100 percent silicone with minimum movement capability of plus/minus 25 percent and recommended by manufacturer for substrates to be sealed; clear.

E. Fasteners for Aluminum: Stainless steel ring nails; 12 gage with 1/4" diameter, flat head, annular threaded, needle point, length as required to obtain 1-1/4" embedment into blocking/framing and full depth into plywood.

F. Anchors for Flashing to Concrete or Masonry: 1/4" diameter, lengths as required to obtain 1-1/2" penetration into masonry backup. Unless otherwise indicated, provide 3 inch edge distance.
   1. Product: Nylon Nail-in with stainless steel drive pin manufactured by Powers Fasteners Inc.

G. Plastic Cement: ASTM D 4586, Type I.

2.03 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.. Form on a bending brake. Perform shaping, trimming, and hand seaming in the shop to the maximum extent possible.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch; miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams. Form metal with full regard for expansion and contraction to avoid buckling or other deformation in service. All lines and arrisses shall be straight and crisp except where thickness of metal dictates radius bend.

E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

G. At ALL horizontal and vertical lap and butt seams provide membrane strip atop seams with formed metal cap flashing.

H. Unless indicated otherwise, provide expansion joints at 24 feet on centers maximum and at 2 feet from all changes in flashing direction (each side) and from all terminations of flashing.

I. Space rivets 1 inch on center unless indicated otherwise.

J. Prefabricate corner pieces and end dams with locked and riveted joints, sealed watertight at aluminum flashing.

K. Provide backer plates as required at through-wall flashing transitions and corners, make fully watertight. Backer plates shall be continuous to cover gaps to be overlain by membrane flashing at all deck and column to wall transitions. Secure to framing or plywood at 6" centers and within 1/2" of corners and edges.

L. Fabricate flashings to allow toe to extend minimum 2 inches over vertical roofing terminations. Return and brake edges.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant. See Drawings, for 2 piece reglet flashings at masonry walls and other locations indicated.

C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 GENERAL REQUIREMENTS FOR METAL FLASHING

A. Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather, without failing.

B. Schedule and coordinate sheet metal installations with the work of other trades where it is integral or continuous therewith. Materials furnished under this Section that are to be built-in by other trades shall be delivered to the site in sufficient time to avoid delays to construction progress. Instruct other trades concerning the location and placement of reglets, wood nailers, and cleats.

C. Surfaces to which roofing and sheet metal are to be applied shall be even, smooth, sound, thoroughly clean and dry and free from projecting nail heads or other defects that would affect the application. Report in writing any unsatisfactory surfaces to the Contractor.

D. Where flashing abuts or members into adjacent dissimilar metals, the juncture shall be executed in a manner that will facilitate drainage and thus minimize the possibility of galvanic action. Note: All metalwork shall be isolated from contact with pressure treated wood products, using roofing membrane, felts, or approved coatings.

E. All accessories or other items essential to the completeness of the sheet metal installation, though not specifically shown or specified, shall be provided. All such items, unless otherwise indicated on Drawings or specified, shall be of the same kind of material as the item to which applied and the gauges shall conform to recognized industry standards of sheet metal practice.

F. Provide expansion joints in sheet metal work at intervals not greater than forty (40') feet. Expansion joints shall be fabricated in accordance with the recommendations of the Architectural Sheet Metal Manual (SMACNA) and as specified herein.

1. Begin expansion joint construction by setting an 8" wide cleat. Lap ends of metal work over base sheet, leaving 1/2" clear space between butt ends. Set ends in full bed of sealant. Cover entire joint assembly with a 4 inch wide metal cover, finish to match other metal work and secured allowing for movement.

G. Fabricate and install sheet metal with lines, arises, and angles sharp and true and plane surfaces free from objectionable wave, warp, or buckle. Exposed edges of sheet metal shall be folded back to form a 1/2" wide hem on the side concealed from water leakage under all

weather conditions. The workmanship and methods employed for framing, anchoring, cleating, and the expansion and contraction of sheet metal work shall conform to applicable details and description as indicated in current edition of the following publications unless other methods are indicated on project Drawings or specified herein.

1. Architectural Sheet Metal Manual as published by the Sheet Metal and Air Conditioning Contractors National Association, Inc., and hereinafter referred to as "The SMACNA Manual".

H. All metal work terminating on roofing shall be provided with flanges for nailing. Wood nailers shall be provided beneath flanges and roofing for nailing of the metal flanges.

I. Provide cleats, edge and drip strips where sheet metal extends over edges and where necessary to secure sheet metal work at fascias, and elsewhere. Form edge strips in lengths of 8' or 10'. The ends shall be butted together, leaving approximately 1/4" space for expansion. Secure to building construction with fasteners spaced not over 12" on centers. Install strips in continuous, long lengths to allow metal work to be hooked over lower edge at least 1/2".

J. Flash intersections of roofs with vertical surfaces as detailed and indicated on the Drawings, or otherwise required to provide watertight construction and to suit job conditions.

K. Seams shall always be made in direction of flow.

3.04 INSTALLATION

A. Conform to Drawing details, SMACNA Architectural Sheet Metal Manual recommendations and National Roofing Association Manual recommendations.

B. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.

C. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

D. Seal metal joints watertight. At ALL lap and butt joints provide secondary membrane strip flashing across seams, minimum 6-inch strip. Conceal strip flashing with metal cover to match general formed flashing.

3.05 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for field inspection requirements.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

3.06 SCHEDULE FOR FABRICATED ALUMINUM METALWORK

A. Applicable to locations as indicated on Drawings to receive aluminum flashing.

1. Cleats: Aluminum, 0.050 inch.
2. Scuppers: Aluminum, 0.060 inch.
3. Diverters: Aluminum: 0.060 inch.
4. Base Flashing: Aluminum: 0.040 inch.
5. Vertical Termination Strips: 0.028 inch.
6. Miscellaneous Flashings: Aluminum: 0.040 inch or as required, unless otherwise indicated on Drawings.

3.07 CLEANING AND PROTECTION

A. Clean all metalwork to remove all fingerprints, oils, etc.

B. Remove from roof surfaces all scraps and metal debris immediately. Extreme care shall be exercised to prevent sharp metal scraps or waste nails from coming into contact with membrane materials.

END OF SECTION

SECTION 07 72 00
ROOF ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-penetrating personnel anchors.

B. Snow guards.

1.02 RELATED REQUIREMENTS

A. Section 07 53 00 – Elastomeric Membrane Roofing.

B. Section 07 62 00 - Sheet Metal Flashing and Trim: Roof accessory items fabricated from sheet metal.

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

1.03 REFERENCE STANDARDS

A. 29 CFR 1910.23 - Guarding floor and wall openings and holes; current edition.

B. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

C. ASTM A792 - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2022.

D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

E. UL - Building Materials 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: Manufacturer's data sheets on each product to be used 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. Snow Guard Shop Drawings: Include roof plans showing layouts and attachment details of snow guards, stamped and sealed by a professional engineer licensed in the jurisdiction of the project.

1. Include registered professional engineer wet-stamped calculation for number and frequency of snow guard attachments based on designed roof snow load, roof slope, roof dimensions, specific roof profile name, material type, gauge thickness and brand of manufacturer; brand and model of snow retention device.
2. Proof of Product Testing: Results of appropriate product tensile load testing, issued by a recognized ISO 17025 accredited independent testing laboratory, showing the mean (of a minimum three test pulls) ultimate load-to-failure value of attachment clamping device

E. Warranty: Submit executed copy of manufacturer’s standard warranty.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

1.07 WARRANTY

A. . Provide manufacturer's standard product warranty for roof hatches and vents for a period of five (5) years against defects in materials and/or workmanship.

PART 2 PRODUCTS

2.01 NON-PENETRATING ROOF GUARDS

A. Personnel Anchors: Non-penetrating tie-off anchor system, including anchor, counterweights and fittings.
   1. Basis-of-Design Product: Kee Anchor Tieoff Point, By Kee Safety, Inc.
      a. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Hot-dipped galvanized steel, free-standing, movable non-penetrating, deadweight anchor system for use on roofs with up to 5° pitch. OSHA compliant roof anchor for one worker in fall arrest or two workers in fall restraint. Incudes 4 rubber molded weights and 8 hot dip galvanized weights for a total weight of 660 lbs. The rubber molded weights are equipped with 100 suction cups to maximize grip with the roof membrane. The system is designed to be used with an approved shock-absorbing lanyards and a full body harnesses to always provide safe access.
   3. Provide 1 unit for addition roof.

2.02 PIPE-TYPE SNOW GUARDS

A. Pipe-Type, Seam-Mounted Metal Snow Guards for Standing-Seam Metal Roofs:
   1. Description: Snow guard two pipe assembly with brackets, anchored to standing seam metal roof seams with non-penetrating brackets. Attachment system to provide attachment to standing seam metal roofs, with the following requirements:
      a. With only minor dimpling of panel seams.
      b. Without penetration through roof seams or panels.
      c. Without use of sealers or adhesives.
      d. Without voiding roof warranty.
   2. Performance Requirements: Provide snow guards to withstand exposure to the weather and environmental conditions, and resist design forces without failure due to defective manufacturing.
      a. Loading: Design snow guard system to resist minimum design roof snow load(s). See structural drawings for roof design snow loads.
      b. Factor of Safety: Utilize a factor of safety ≥ 2 to determine allowable loads from ultimate tested clamp tensile mean load values.
   3. Components:
      a. Clamps
         1) Manufactured from 6000-series aluminum extrusions conforming to ASTM B221 or aluminum castings conforming to ASTM B85 and to AA Aluminum Standards and Data.
            (a) Clamp model to be as recommended by the manufacturer for the specific seam profile used on the project.
            (b) Setscrews: 300-series stainless steel, 18-8 alloy, 3/8 inch (9.525 mm) diameter, with round nose point.
            (c) Attachment bolts: 300-series stainless steel, 18-8 alloy, 8 mm diameter, hex flange bolt.
            (d) Basis of Design: S-5!; S-5-TXL Clamp if compatible with metal roofing.
      b. Pipe Brackets:
         1) Manufactured from 5000-series alloy and temper aluminum conforming to ASTM B221 and AA Aluminum Standards and Data.
      c. Pipe Couplings (Splices):
         1) Manufactured from 6000-series alloy and temper aluminum extrusions conforming to ASTM B221 and AA Aluminum Standards and Data.
      d. Pipes (Cross Members):

1) Manufactured from 6000-series alloy and temper aluminum extrusions conforming to ASTM B221 and AA Aluminum Standards and Data.
(a) Model: DualPipe.

e. Pipe Collar:
1) Manufactured from 6000-series alloy and temper aluminum extrusions conforming to ASTM B221 and AA Aluminum Standards and data, with ¼-20 x 3/8 inch (9.525 mm) stainless steel setscrew.
(a) Model: DualCollar.

f. Snow and Ice Clips:
1) Aluminum, with rubber foot, minimum 3 inches (76.2 mm) wide.
(a) Model: DualClip III for standing seam heights 1.75 inches (44.45 mm) to 3.25 inches (82.55 mm).

g. Accessories: Manufacturer's standard; include splice connectors, collars, end caps, and associated mounting accessories matching rail finishes and meeting performance requirements.

h. Finish: Powder coat finish; color as selected by Architect.

4. Basis-of-Design Product: Subject to compliance with requirements, provide S-5! Metal Roof Innovations, Ltd.; DualGard Snow Retention System or comparable product by one of the following:
a. Rocky Mountain Snow Guards, Inc.
b. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

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. Prior to proceeding with an installation, verify that all necessary blocking, bracing, and supports have been provided.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing weather integrity.

3.04 SNOWGUARD INSTALLATION

A. Install system in accordance with manufacturer's instructions and approved shop drawings.

3.05 CLEANING

A. Clean installed work to like-new condition.

B. Position roof hatches as required by OSHA.

3.06 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

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 05 31 00 – Steel Decking.

C. Section 07 84 00 - Firestopping.

D. Section 09 21 16 - Gypsum Board Assemblies: Gypsum board fireproofing.

E. 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 assembles 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.

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) Carboline; 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 07 95 13 – Expansion Joints Cover Assemblies.

F. Section 09 21 16 - Gypsum Board Assemblies: Gypsum wallboard fireproofing and deflection head track types.

G. Division 21 - Fire Protection: Firestopping of fire protection work.

H. Division 22 - Plumbing: Firestopping of plumbing work.

I. Division 23 - HVAC: Firestopping of heating, ventilating and air conditioning work.

J. Division 26 - Electrical: Firestopping of electrical work.

K. Division 27 – Communications: Firestopping of communications work.

L. 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.

E. Owner-provided field quality control.

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 MOCK-UPS AND SAMPLE INSTALLATIONS

A. Mock-Up: Provide sealants for exterior wall mock-up.
1. Mock-up panels shall demonstrate actual wall construction, detailing and workmanship.
2. No work shall progress until the Architect has reviewed the mock-up panels. Panels shall be revised as necessary to secure the Architect’s acceptance and shall then become the standard of comparison for all related exterior wall work.
3. Mock-up panels shall not be destroyed or moved until the Work is complete and accepted by the Architect. Upon completion of construction, mock-up panel(s) shall be removed.

B. Sample Installations:
1. Provide sealant joints in conjunction with sample window installation per Section 08 43 13 –Aluminum Storefront and Entrances.
2. Provide sample exterior sealant installation at brick masonry. No work shall progress until the Architect has reviewed the sample installation. Make revisions as necessary to secure the Architect’s acceptance and shall then become the standard of comparison for all related exterior wall work.
3. Joint sealer manufacturer representative shall review the installation and compatibility between adjoin materials and submit a report based on inspection of the mock-up(s).

1.08 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.

1.09 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. General Purpose Exterior - Nonstaining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus 100 percent and minus 50 percent, minimum.
   2. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
   3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
   4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
   5. Color: To be selected by Architect from manufacturer's standard range.
   6. Cure Type: Single-component, neutral moisture curing.
   7. Service Temperature Range: Minus 20 to 180 degrees F.
   8. Applications: High movement joints.
      a. Joints between concrete and other materials.
      b. Joints between metal frames and other materials.
      c. Joints between dissimilar materials and building construction.
   9. Note: Compatibility with materials sealant shall be in contact with shall be verified prior to use.
   10. Limitations: Not for use in structural applications, below grade or to materials that outgas, on brass, copper, or materials that can corrode, at joints continuously immersed in water, interior firestop sealing, at materials that bleed oils, plasticizers, or solvents, in confined spaces, to surfaces that will be painted, to surfaces in contact with food, to wet surfaces, to architectural finishes without prior testing, and as otherwise limited by the manufacturer.
   11. Products:
      a. Dow; DOWSIL 790 Silicone Building Sealant.
      b. Pecora Corporation; Pecora 890 NST (Non-Staining Technology).
      c. Tremco Commercial Sealants & Waterproofing; Spectrem 1.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

B. 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.

C. 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.

D. 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 Section01 60 00-Product Requirements.

E. Butyl Sealant: Solvent-based; ASTM C1311; single component, nonsag; not expected to withstand continuous water immersion or traffic.
1. Hardness Range: 10 to 30, Shore A, when tested in accordance with ASTM C661.
2. Color: To be selected by Architect from manufacturer's standard range.
3. Service Temperature Range: Minus 13 to 180 degrees F.
4. Applications: Exterior thresholds and where indicated.
5. Products:
   a. Pecora Corporation; Pecora BC-158 Butyl Rubber Sealant.
   b. Tremco Commercial Sealants & Waterproofing; Tremco Butyl Sealant..
   c. 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.

B. Exterior Floor Joint Sealant - Semi-Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Class 25, Uses T, M and A; single component.
1. Applications:
   a. Expansion joints in sidewalks and building slabs and foundation walls.
2. Composition: Single or multicomponent.
3. Durometer Hardness, Type A: 35 to 45, minimum, when tested in accordance with ASTM D2240.
4. Color: To be selected by Architect from manufacturer's standard colors.
5. Tensile Strength: 250 to 300 psi in accordance with ASTM D412.
6. Products:
   a. Tremco Commercial Sealants & Waterproofing; Vulkem 45 SSL.
   b. 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 07 91 00
PREFORMED JOINT SEALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Precompressed foam seals.

1.02 RELATED REQUIREMENTS

A. Section 07 90 05 - Joint Sealants: Liquid and mastic joint sealants and their backing materials.

B. Section 07 95 13 – Expansion Joint Covers: Expansion joint cover assemblies.

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

1.03 REFERENCE STANDARDS

A. ASTM D1056 – Standard Specification for Flexible Cellular Materials – Sponge or Expanded Rubber; 2020.

B. ASTM D2240 – Standard Test Method for Rubber Property – Durometer Hardness; 2015 (Reapproved 2021).

C. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

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 technical data sheets for each product, including chemical composition, movement capability, color availability, limitations on application, 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. Color Cards: For color selection.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section with at least five years of experience.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a two year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealers that fail to achieve watertight seal or exhibit loss of adhesion or cohesion.

PART 2 PRODUCTS

2.01 PRECOMPRESSED FOAM SEALS

A. Expansion Joint Seal, Type 1: Comprised of urethane, modified-acrylic impregnated, open-cell polyurethane, or closed-cell neoprene foam impregnated with water-repellent, and with self-adhesive faces protected prior to installation by release paper.
   1. Color: As selected by Architect.
   2. Size as required to provide weathertight seal when installed.
   3. Calculate size according to manufacturer's recommendations.
   4. Measure size of existing joints before selecting seal width.
   5. Fire-Rating: None.
   6. Products:
      a. Sika Emseal; Seismic Colorseal-DS.
      b. Willseal: Seismic, Double sided.
      c. MM Systems: SIF, Dual sided.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACCESSORIES

A. Adhesive: As recommended by seal manufacturer.

B. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and strip seal.

C. Substrate Cleaner: Non-corrosive, non-staining type recommended by seal manufacturer; compatible with joint forming materials.

D. Sealant: Manufacturer recommended sealant for sealing of Joint Seal to adjacent construction.

E. Primer: Type recommended by seal manufacturer to suit application; non-staining.

F. Backing Tape: Self-adhesive polyethylene tape with surface that seal will not adhere to.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive this work.

B. Measure joint dimensions and verify that seal products are of the correct size to properly seal the joints.

3.02 PREPARATION

A. Properly prepare construction components adjacent to the work of this section to prevent damage and disfigurement due to this work.

3.03 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

B. Precompressed Foam Seals:
   1. Install only when ambient temperature is within recommended application temperature range of adhesive. Consult manufacturer when installing outside this temperature range.
   2. Prepare joints and install seals in accordance with manufacturer's written recommendations.
   3. Remove loose materials and foreign matter that could impair adhesion of sealant.
   4. Do not stretch precompressed seal; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch below adjoining surface.
   5. Seal joint between joint seal and adjacent construction in accordance with manufacturer's installation instructions.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

END OF SECTION

SECTION 07 95 13
EXPANSION JOINT ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Expansion joint assemblies for floors, walls and ceiling surfaces.

B. Metal roof to wall expansion joint assemblies.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Placement of flooring joint assemblies.

B. Section 04 20 00 - Unit Masonry: Placement of joint assembly in masonry.

C. Section 07 53 00 – Elastomeric Membrane Roofing: Roof expansion joints.

D. Section 09 21 16 - Gypsum Board Assemblies: Placement of wall and ceiling expansion joint assembly.

E. Section 07 91 00 – Preformed Joint Seals: Foam expansion joints.

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

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

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 A755/A755M - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products; 2018.

D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

E. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2020.

F. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

G. ASTM D2178/D2178M - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing; 2015a (Reapproved 2021).

H. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).

I. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

J. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

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 joint assembly profiles, profile dimensions, anchorage devices, available colors and finish. Provide manufacturer's installation instructions Indicating rough-in sizes; provide templates for cast-in or placed frames or anchors; required tolerances for item placement

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 joint and splice locations, miters, layout of the work, affected adjacent construction, anchorage locations.

E. Samples: Submit samples 6-inch-long, illustrating profiles, dimensions, colors, and finishes selected.

PART 2 PRODUCTS

2.01 EXPANSION JOINT COVER ASSEMBLIES

A. Expansion Joint Cover Assemblies - General: Factory-fabricated and assembled; designed to completely fill joint openings, sealed to prevent passage of air, dust, water, smoke; suitable for traffic expected.
   1. Joint Dimensions and Configurations: As indicated in this Section or on drawings.
   2. Joint Cover Sizes: Selected to suit joint width and configuration, based on manufacturer's published recommendations and limitations.
   3. Lengths: Provide covers in full lengths required; avoid splicing wherever possible.
   4. Anchors, Fasteners, and Fittings: Provided by cover manufacturer.

B. Floor Joint Covers: Coordinate with indicated floor coverings.

C. Covers in Fire Rated Assemblies: Provide cover assembly having fire rating equivalent to that of assembly into which it is installed.
   1. Acceptable Evaluation Agencies: UL, WH, ULC, and Intertek.

D. Basis of Design Manufacturer:
   1. As noted in Types section.
   2. Acceptable Substitute Manufacturers:
      a. Balco, A CSW Industries Company.
      b. MM Systems.
      c. Inpro.
      d. C-S Group.
      e. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 EXPANSION JOINT MATERIALS

A. Covers and Systems suitable for conditions shown on drawings.

B. Provide for all building expansion joints in floor slabs to maintain fire separation, continuously, whether detailed on drawings or not. Floor fire ratings shall be 2 hour rated unless noted otherwise.

C. Provide for all building expansion joints in walls and ceilings at exposed conditions, and as shown on drawings for specific conditions. Provide smoke or fire rated joints within rated walls to match the fire or smoke rating of the wall.

D. Expansion Joint Cover Types:
   1. Metal Plate Expansion Joint: Mill aluminum finished plate, fastened on one side of joint with countersunk screws.
      a. Floor to Floor:
         1) Joint Opening: Verify in Field
      b. Basis of Design Product:
         1) Balco; GF-2P
   2. Expansion Joint Cover, Type 1; Mill aluminum plate for carpet overlay
      a. Floor to Floor:
         1) Joint Opening: 1 inch.
      b. Basis of Design Product:
         1) Balco; BCP-1-250.

3. Expansion Joint Cover, Type 2
    a. Floor to Floor:
        1) Joint Opening: As determined in the field..
        2) Recess Depth: 7/8 inch.
        3) Flooring Recess: As required for specified flooring.
        4) Color: As selected by Architect.
    b. Basis of Design Product:
        1) Balco; NBR Series.
4. Expansion Joint Cover, Type 3; Mill aluminum finish.
    a. Floor to Wall:
        1) Joint Opening: 3 inches.
        2) Recess Depth: 3/4 inch.
    b. Basis of Design Product:
        1) Balco; SBNBL-1.5-3.
5. Expansion Joint Cover, Type 4; Silicone joint with aluminum retainer tracks.
    a. Wall to Wall
        1) Joint Opening: 3 inches.
    b. Basis of Design Product:
        1) Inpro; 112 Recessed Mount for 5/8” Drywall.
6. Expansion Joint Cover, Type 5; Fire-rated, Silicone joint with aluminum retainer tracks and accessory fire rated joint insert.
    a. Wall to Wall
        1) Joint Opening: 3 inches.
    b. Fire Rating: 1 hour.
        1) Expansion Joint Fire Barrier, Product:
            (a) Balco; Metablock.
    c. Basis of Design Product:
        1) Balco; IS-3.

2.03 FABRICATION

A. Back paint components in contact with cementitious materials. Galvanize embedded ferrous metal anchors and fastening devices.

B. Shop assemble components and package with anchors and fittings. Provide joint components in single length wherever practical. Minimize site splicing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.

B. Provide anchoring devices for installation and embedding under Section 03 30 00.

3.02 INSTALLATION

A. Install components and accessories in accordance with manufacturer's instructions.

B. Align work plumb and level, flush with adjacent surfaces.

C. Rigidly anchor to substrate to prevent misalignment.

3.03 PROTECTION

A. Do not permit traffic over unprotected floor joint surfaces.

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. Sliding Doors.
3. Other doors to the extent indicated.

B. Commercial door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical and access control door hardware.
3. Electromechanical and access control door hardware power supplies, back-ups and surge protection.
4. Automatic operators.
5. Cylinders specified for doors in other sections.

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

1	Continuous Hinge	
1	Fire Rated Rim Exit, Nightlatch	
1	Cylinder	
1	Electric Strike	
1	Pick Plate/Latch Guard	
1	Pull	
1	Wall Stop	
1	Threshold	
1	Door Position Switch	
1	Card Reader	By Owner
1	Power Supply	
1	Wiring Diagram	

Set: 2.0

1	Continuous Hinge	
1	Fire Rated Rim Exit, Nightlatch, Trimless	
1	Cylinder	
1	Electric Strike	
1	Pick Plate/Latch Guard	
1	Pull (Match Existing)	
1	Surface Closer	
1	Wall Stop	
1	Threshold	
1	Door Position Switch	
1	Card Reader	By Owner
1	Power Supply	
1	Wiring Diagram	

Notes: Operation:
*Door normally closed and secured.
*Upon use of mechanical key or presentation of authorized credentials electric strike to release allowing authorized entry.
*Upon loss of power door to remain locked.
*Always free egress.

Set: 4.0

1	Continuous Hinge	
1	Dummy Bar, Exit Only	
1	Pull	

Notes: Operation:
* Door normally closed and unlocked.
*Always free egress.

Set: 3.0

1 Continuous Hinge
1 Classroom Lock
1 Electric Strike
1 Surface Closer
1 Wall Stop
3 Silencer
1 Armor Plate
1 Card Reader
1 Power Supply
1 Wiring Diagram

Notes: Operation:
*Upon use of mechanical key or presentation of authorized credentials strike to release allowing authorized entry.
*Use
*Always free egress.

Set: 5.0

6 Hinge, Full Mortise, Hvy Wt
2 Fire Rated Surf Vert Rod, Passage
2 Surface Closer
2 Kick Plate
2 Wall Stop
2 Silencer

Set: 6.0

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

Set: 7.0

3	Hinge, Full Mortise, Hvy Wt
1	Fire Rated Rim Exit, Passage
1	Surface Closer
1	Kick Plate
1	Gasketing

Set: 8.0

3	Hinge, Full Mortise, Hvy Wt
1	Fire Rated Rim Exit, Passage
1	Surface Closer
1	Kick Plate
1	Wall Stop
1	Electromagnetic Holder
1	Gasketing

Notes: Operation:
*Doors normally held open via electromagnetic hold open.
*Upon loss of power or fire alarm activation magnets to release allowing doors to close and positively latch.
*Always free egress.

Set: 9.0

6	Hinge, Full Mortise, Hvy Wt
1	Self Latch Flush Bolt Set
1	Storeroom Lock
2	Wall Stop
2	Silencer

Set: 10.0

3 Hinge, Full Mortise, Hvy Wt
1 Storeroom Lock
1 Surface Closer
1 Kick Plate
1 Wall Stop
3 Silencer

Set: 11.0

3 Hinge, Full Mortise, Hvy Wt
1 Classroom Lock
1 Wall Stop
3 Silencer

Set: 12.0

3 Hinge, Full Mortise, Hvy Wt
1 Classroom Lock
1 Surface Closer
1 Wall Stop
1 Gasketing
1 Door Bottom

Set: 13.0

1 Continuous Hinge
1 Push Plate
1 Pulls
1 Surface Closer
1 Armor Plate
3 Silencer

Set: 14.0

6	Hinge, Full Mortise, Hvy Wt
1	Dust Proof Strike
1	Flush Bolt
1	Classroom Lock
1	Cylinder
2	Wall Stop
2	Silencer

Set: 15.0

3	Hinge, Full Mortise, Hvy Wt
1	Indicator Cylindrical Lockset
1	Surface Closer
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 14 16 - Flush Wood Doors.

B. Section 08 71 00 - Door Hardware.

C. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.

D. Section 09 91 23 - Interior Painting: Field painting.

E. Division 26 - Electrical: Access Control and Security system interface with doors and frames.

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

G. 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. Exterior Doors: Thermally insulated.
1. Grade: ANSI A250.8 - SDI-100; Level 2 – Heavy-Duty, Physical Performance Level B, Model 2 – Seamless.
a. Door Face Metal Thickness: 18 gauge, 0.042 inch, minimum.
b. Exception: Grade for all doors in frame openings over 72" wide: Level 4, Physical Performance Level A, Model 2 - Seamless (14 gauge).
2. Thermal Performance: U-0.35; R-2.86 for door, thermally-broken frame and threshold assembly.
3. Zinc Coating: A60/ZF180 galvanized coating; ASTM A653/A653M.
4. Core: Polyurethane foam block, spanning the full thickness of the interior spaces of the door and securely attached to the faces using an epoxy glue.
a. Exception: Core for exterior fire-rated doors: non-asbestos mineral fiberboard.
5. Door Thickness: 1-3/4 inches, nominal.

D. 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.

E. 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. Exterior Door Frames, Non-Fire-Rated: Face welded type, thermally broken.

E. Interior Door Frames:
1. Faced Welded: All door frames, less than 42”, unless otherwise indicated.

F. Interior Frames for Glazing (Borrowed Lites): Construction and face dimensions to match door frames, and as indicated on Drawings.

G. Corner joints shall be die mitered and have all contact edges closed tight and continuously welded.

H. 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.

I. Minimum depth of stops shall be 5/8". Use 3/4" only where required for fire rating or security.

J. 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.

K. 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.

L. Frames shall be provided with supplemental internal concealed steel reinforcement, as engineered by the manufacturer.

M. 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.

N. 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 14 16
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush and flush glazed configuration; fire-rated, and non-rated.

B. Factory finishing of wood doors.

1.02 RELATED REQUIREMENTS

A. Section 08 11 13 - Hollow Metal Doors and Frames.

B. Section 08 71 00 - Door Hardware.

C. Section 08 80 00 - Glazing: Site glazing of doors.

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

E. Mechanical Drawings: Required door undercuts for ventilation.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.

C. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.

D. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives 2022.

E. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.

F. UL 10B - Standard for Fire Tests of Door Assemblies Current Edition, Including All Revisions.

G. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

H. UL 1784 - Standard for Air Leakage Tests of Door Assemblies Current Edition, Including All Revisions.

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 door core materials and construction; veneer species, type and characteristics. Submit manufacturer's certification of compliance with quality standards.

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: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.

E. Samples:
   1. Submit samples of door veneer, 6 by 6 inch in size illustrating wood grain, stain color, and sheen for the selected range to confirm choice.
   2. Samples submitted and accepted shall serve to reflect the entire range of (color, texture, grain and sapwood/heartwood variation and shall be used as the standard for acceptance or rejection of installed materials.

F. Manufacturer's certification that products are manufactured in the United States.

G. Manufacturer's Installation Instructions: Indicate special installation instructions.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum ten years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

C. Fire rated door assemblies: Conform to the following standards:
   1. UL 10c UBC-10 Pressure Fire Test of Door Assemblies
   2. NFPA 252 Methods of Fire Tests of Door Assemblies
   3. NFPA 80 Standard for Fire Doors and Windows
   4. NFPA 101 Life Safety Code
   5. NFPA 105 Standard for Smoke and Draft Control Assemblies
   6. Fire & Smoke/Draft labeled and listed by Underwriters Laboratories or Warnock Hersey.

D. All components of a fire-rated assembly (door, glazing, locks, closers, latches, lite frames, louvers, hinges, etc.) shall be rated at or exceed the intended fire protection rating indicated for the assembly.
   1. Pressure Test: After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches or less above the sill.
   2. Wood doors with fire rating requirements exceeding 20 minutes shall be Category A doors with integral intumescent strips.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect materials during transit, storage, and handling to prevent deterioration, damage and soiling. Package each door at the factory in a separate heavy sealed poly bag. Mark each bag at top and bottom of doors for location to correspond with opening number on the Drawings.

B. Accept doors on site in manufacturer's packaging. Inspect for damage. In the event of damage, immediately make all repairs and replacements necessary for approval of the Architect and at no additional cost to the Owner.

C. Protect doors with resilient packaging . Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation. Deliver door to job site only when building is dry and has reached average prevailing relative humidity of locality.

D. Coordinate the work with door opening construction, door frame and door hardware installation. 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. Doors and 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.

1.08 WARRANTY

A. See Section 01 78 10 - Warranties for additional warranty requirements.

B. Interior Doors: Provide a special manufacturer's warranty, signed by both the manufacturer, installer and Contractor, for the life of the installation.

C. Include coverage for delamination of veneer, defective materials, telegraphing core construction, and warping. Unsatisfactory warpage shall be more than 1/4" in a 42" x 84" section and telegraphed core construction shall be defined as exceeding 0.01 inch in a 3 inch span. The warranty shall also include refinishing and reinstalling which may be required due to repair or replacement of defective doors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:
   1. Forte Opening Solutions.
   2. Oregon Door.
   3. VT Industries, Inc.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DOORS

A. Doors: See drawings for locations and additional requirements.
   1. Quality Level: Premium Grade, in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, latest edition.
   2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at each location.
   2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type structural composite lumber core (SCLC), plies and faces as indicated.

B. Fire-Rated Doors: Mineral core, Type FD, plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.
   1. 20 min Particle Core: AWI Type FD 1/3.
   2. Fire-rated Mineral Core C Label: AWI Type FD 3/4. Category A with integral intumescent strips. Fire-resistive particle board core C Label also allowed.
   3. Fire-rated Mineral Core B Label: AWI Type FD 1-1/2. Category A with integral intumescent strips.
   4. Cores for fire-rated doors shall be non-combustible mineral board, 30.8 to 34.7 pcf, containing no asbestos, as required for scheduled fire-resistance.
   5. Provide fire-rated pairs of doors with fire-retardant stiles of labeled and listed matching face veneer without formed steel edges and astragals.

C. Doors scheduled to receive closers and /or exit devices shall have solid lumber rails, without compromising labeling or listing requirements. Thru-bolting of finish hardware shall not be permitted, unless specifically noted elsewhere in the Contract Documents.

2.04 DOOR FACINGS

A. Veneer Facing for Transparent Finish: Select White Birch, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
   1. Vertical Edges: Same species as face veneer.
   2. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet of each other when doors are closed.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:
   1. Provide solid blocks at lock edge for hardware reinforcement.
   2. Provide solid blocking for other throughbolted hardware.

C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

D. Factory machine doors for hardware to match existing conditions at existing door frames, subject to modifications during shop drawing review.

E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

2.06 FINISHES - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Stain with Transparent Finish:
      a. System - 11, Polyurethane, Catalyzed.
      b. Stain: Color as selected by Architect from Manufacturer's standard range.
      c. Sheen: Satin.

B. Seal door top edge with color sealer to match door facing.

2.07 ACCESSORIES

A. Hollow Metal Door Frames: See Section 08 11 13.

B. Glazing: See Section 08 80 00.
   1. Note: The bottom edge of all lites shall be at least 10 inches above the floor and not more than 43 inches above the floor.

C. Door Window Frames: Door window frames with glazing securely fastened within door opening.
   1. Size: As indicated on drawings.
   2. Frame Material: 18 gauge, 0.0478 inch, galvanized steel[<>].
   3. Metal Finish: Polyester powder coating, color as selected by Architect.
   4. Glazing: As indicated on Drawings. See Section 08 80 00 – Glazing.
   5. Manufacturers:
      a. All Metal Stamping.
      b. National Guard Products.
      c. Activar Construction Products Group
      d. Substitutions: See Section01 60 00-Product Requirements.

D. Door Hardware: See Section 08 71 00.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine all doors before hanging and reject doors with defects.

B. Verify existing conditions before starting work.

C. Verify that opening sizes and tolerances are acceptable.

D. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.

B. Install fire-rated doors in accordance with NFPA 80 requirements.

C. Install smoke and draft control doors in accordance with NFPA 105 requirements.

D. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

E. Use machine tools to cut or drill for hardware.

F. Coordinate installation of doors with installation of frames and hardware.

G. Coordinate installation of glazing.

3.03 TOLERANCES

A. Comply with specified quality standard for telegraphing, warp, and squareness.

B. Edge Clearances shall be provided as follows:
   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 doors for smooth and balanced door movement.

B. Adjust closers for full closure.

C. Align in frames for uniform clearance at each edge. Restore finish before installation if on-site fitting or machining is required. Replace or re-hang any doors which do not swing or operate freely, or are warped or twisted. Pre-finished doors damaged prior to acceptance shall be repaired or replaced. Doors may be prepared or refinished if work complies with requirements and show 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 08 43 13
ALUMINUM STOREFRONTS AND ENTRANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Aluminum stile and rail doors and frames.

C. Weatherstripping.

1.02 RELATED REQUIREMENTS

A. Section 07 90 05 – Joint Sealant: Perimeter sealant between framing and adjacent construction.

B. Section 08 71 00 – Door Hardware: Hardware for doors.

C. Section 08 80 00 - Glazing: Glazing for storefront and doors.

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

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site 2015.

B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.

C. AAMA 611 – Voluntary Specification for Anodized Architectural Aluminum; 2020.

D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections 2009.

E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.

F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.

G. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014 (Reapproved 2021).

H. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2023)

I. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.

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. Coordinate with installation of other components that comprise the exterior enclosure.

B. Pre-installation Meeting: Conduct 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 component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage 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 system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

E. Samples: Submit two samples illustrating finished aluminum finish, glass, glazing materials.

F. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

G. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

B. Installer's Qualifications: Company specializing in the installation and fabrication of aluminum glazing systems with a minimum of five years of documented experience and approved by the manufacturer.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.09 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.10 WARRANTY

A. See Section 01 78 10 - Warranties for additional warranty requirements.

B. Provide ten year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

C. Provide ten year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 ALUMINUM-FRAMED STOREFRONT

A. Aluminum-Framed Storefront: Front/Outboard-set, thermally broken, factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Application: Exterior storefront.
   2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
   3. Glazing Rabbet: For 1 inch insulating glazing.
   4. Finish: Class I Natural Anodized Finish.
      a. Factory finish all surfaces that will be exposed in completed assemblies.
      b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
      c. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

5. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
6. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
7. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
8. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
9. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
10. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
11. Maintain continuous air barrier and/or vapor retarder seal throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel, and heel bead of glazing compound.
12. Performance Requirements
    a. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
        1) Design Wind Speed: See Structural Drawings.
        2) Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
    b. Movement: Accommodate movement between storefront and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
    c. Air Infiltration (High-performance Entrance Doors), ASTM E283: Limit air infiltration through assembly to 1.0 cu ft/min/linear ft of crack length, measured at 1.56 psf differential pressure across assembly.
    d. Thermal Transmittance (High-performance Entrance Doors), AAMA 1503, AAMA 507: 0.43 BTU/hr/ftsq/degreeF.
    e. Condensation Resistance Factor, AAMA 1503 (High-performance Entrance Doors): 57 for frame and 71 for 1 inch insulating glass installed.
    f. Water Leakage, ASTM E331: None at specified pressure differential.
13. Products:
    a. Tubelite; TU14000/O.
    b. Kawneer; VersaGlaze 451UT.
    c. Substitutions: See Section 01 60 00 - Product Requirements

B. Aluminum-Framed Storefront: Center-set, factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
1. Application: Interior storefront.
2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
3. Glazing Rabbet: To match scheduled glazing.
4. Finish: Class I Natural Anodized Finish.
    a. Factory finish all surfaces that will be exposed in completed assemblies.
    b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
    c. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

5. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
6. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
7. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
8. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
9. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
10. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
11. Products:
    a. Kawneer; VersaGlaze 451.
    b. Tubelite: INT14 Interior Storefront.
    c. Substitutions: See Section 01 60 00 - Product Requirements

2.02 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
   1. Framing members for interior applications need not be thermally broken.
   2. Glazing Stops: Flush.

B. Glazing: See Section 08 80 00.

C. Swing Doors, Thermal: Glazed aluminum, wide-stile, thermally-broken.
   1. Thickness: 2-1/4 inches.
   2. Top Rail: 5 inches wide.
   3. Vertical Stiles: 5 inches wide.
   4. Mid Rail: 6 inches wide.
   5. Bottom Rail: 10 inches wide.
   6. Glazing Stops: Square.
   7. Glazing Rabbet: To match scheduled glazing.
   8. Finish: Same as framing.
   9. Air Infiltration (High-performance Entrance Doors), ASTM E283: Limit air infiltration through assembly to 1.0 cu ft/min/linear ft of crack length, measured at 1.56 psf differential pressure across assembly.
   10. Thermal Transmittance (High-performance Entrance Doors), AAMA 1503, AAMA 507: 0.43 BTU/hr/ftsq/degreeF.
   11. Condensation Resistance Factor, AAMA 1503 (High-performance Entrance Doors): 57 for frame and 71 for 1 inch insulating glass installed.
   12. Products:
       a. Tubelite; Thermal Wide Stile Entrance.
       b. Kawneer; 500T Insulpour.
       c. Substitutions: See Section 01 60 00 - Product Requirements

2.03 MATERIALS AND ACCESSORIES

A. Extruded Aluminum: ASTM B221.

B. Sheet Aluminum: ASTM B209.

C. Fasteners: Stainless steel.

D. Exposed Flashings: Aluminum sheet, 20 gauge, 0.032 inch minimum thickness; finish to match framing members.

E. Perimeter Sealant: Type specified in Section 07 90 05.

F. Glass: As specified in Section 08 80 00.

G. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

H. Glazing Accessories: See Section 08 80 00.

2.04 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

2.05 HARDWARE

A. For each door, include weatherstripping, sill sweep strip, and hinges.

B. Other Door Hardware: See Section 08 71 00.

C. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

D. Sill Sweep Strips: Brush type, retracting; provide on all doors.

E. Hinges: Continuous gear type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Coordinate attachment and seal of perimeter air and vapor barrier materials.

I. Install foam insulation sealant in shim spaces at perimeter of assembly to maintain continuity of thermal barrier; see Section 07 21 00.

J. Install glass and infill panels using glazing method required to achieve performance criteria; see Section 08 80 00.

K. Install perimeter sealant in accordance with Section 07 90 05.

L. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 ADJUSTING

A. Adjust operating hardware for smooth operation and to be weathertight when closed and locked. Hardware and parts shall be lubricated as necessary.

3.05 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

C. Remove excess sealant by method acceptable to sealant manufacturer.

3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

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. Electromechanical door hardware.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Hollow Metal Doors and Frames”.
2. Division 08 Section “Flush Wood Doors”.
3. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.
4. 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: 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. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

    a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
    b. Complete (risers, point-to-point) access control system block wiring diagrams.
    c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. 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.

E. 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.

F. 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.

B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

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.
4. Electrical component defects and failures within the systems operation.

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 POWER TRANSFER DEVICES

A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

    a. Pemko - EL-CEPT Series.
    b. Securitron - EL-CEPT Series.
    c. Von Duprin EPT-10

B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

    a. McKinney - Electrical Connecting Kit: QC-R001.
    b. McKinney - Connector Hand Tool: QC-R003.

2. Manufacturers:

    a. McKinney - QC-C Series.

2.5 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
    b. Ives

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.

2.6 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): Medeco.

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.

2.7 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).

2.8 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. Lever Trim:

a. Lever: Forged or Cast
1) Style: NZ (Basis of Design)

b. Escutcheon (Rose): Wrought, forged, or cast, 3-1/2 inch.

2. Manufacturers:

a. Corbin Russwin Hardware - CLX3300 Series. (Basis of Design)
b. Sargent Manufacturing - 10X Line.
c. Schlage – ND-Series.

B. Cylindrical Indicator Locksets, Grade 1 (Commercial Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide locksets with functions and features as follows:

a. Visual status indicators in rose, displaying bold visuals for vacant or occupied lock status.
b. Meets ANSI/BHMA A156.41 for single motion egress.
c. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
d. Three-year limited warranty.
e. Lever Trim:
1) Lever: Forged or Cast
a) Style: NZD Newport (Basis of Design)
2) Escutcheon (Rose): Wrought, forged, or cast, 3-1/2 inch.

2. Manufacturers:

a. ASSA ABLOY ACCENTRA, formerly known as Yale (YA) - YPL 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 DEADBOLTS

A. Requirements:

1. Provide grade 1 deadbolt series conforming to ANSI/BHMA A156.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide deadbolts with standard 2-3/4 inches (70 mm) backset. Provide 2-3/8 inches (60 mm) where noted or if door or frame detail requires. Provide deadbolt with full 1-inch (25 mm) throw, constructed of steel alloy.
4. Provide manufacturer's standard strike.
5. Lock Status Indicator Trim: Where specified, provide escutcheon with lock status indicator widow.

a. Escutcheon height 4.125 inches, width 2.54 inches. Projection 1.32 inches on thumbturn side and 1.28 inches on cylinder side.
b. Unlocked and Unoccupied message will display on white background, and Locked and Occupied message will display on red background.
c. Provide snap-in serviceable window to prevent tampering. Lock must function if indicator is compromised.
d. Indicator window to provide 180-degree visibility.

B. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. Corbin Russwin Hardware – DL3200 Series. (Basis of Design)
b. Sargent Manufacturing – 480 Series.
c. Schlage B600 Series

2.11 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: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    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. Electromechanical exit devices shall have the following functions and features:

    a. Universal Molex plug-in connectors that have standardized color-coded wiring and are field configurable in fail safe or fail secure and operate from 12vdc to 24vdc regulated.
    b. EcoFlex or equivalent technology that reduces energy consumption up to 92% as certified by GreenCircle.
    c. Options to be available for request-to-exit or enter signaling, latchbolt and touchbar monitoring.
    d. Field configurable electrified trim to fail-safe or fail-secure that operates from 12-24VDC.

e. Five-year limited warranty for electromechanical features.

2. Manufacturers:

a. Von Duprin - 98 Series.
1) Narrow design 35A Series for aluminum doors.

b. Sargent Manufacturing (SA) - 80 Series.
1) Narrow design 8500 Series for aluminum doors.

c. Stanley – Apex Series.
1) Narrow stile Apex Series for aluminum doors.

2.12 ELECTRIC STRIKES

A. Electric Strikes: Comply with BHMA A156.31, Grade 1.

1. Provide UL (DIR) listed burglary-resistant electric strike; style to suit locks.
2. Provide non-handed 24 VDC electric strike suitable for door frame material and scheduled lock configuration.
3. Provide field selectable Fail Safe/Fail Secure modes.
4. Provide transformer and rectifier as necessary for complete installation.
5. Connect electric strikes into fire alarm where non-rated doors are scheduled to release with fire or sprinkler alarm condition.
6. Manufacturers:

a. Adams Rite, HES, or Securitron.
b. Von Duprin.

2.13 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

2.14 SURFACE MOUNTED CLOSER HOLDERS

A. Electromagnetic Door Holders: ANSI A156.15 electromagnetic door holder/releases with a minimum 20 to 40 pounds holding power and single coil construction able to accommodate.12VDC, 24VAC, 24VDC and 120VAC. Coils to be independently wound, employing an integral fuse and armatures to include a positive release button.

1. Manufacturers:

a. Norton Rixson - 980/990 Series.
b. LCN

2.15 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.

2.16 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.

2.17 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.

2.18 ELECTRONIC ACCESSORIES

A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Manufacturers:

a. Securitron - DPS Series.

B. Intelligent Switching Power Supplies: Provide power supplies with single, dual or multi-voltage configurations at 12 and/or 24VDC. Power Supply shall have battery backup function with an integrated battery charging circuit. The power supply shall have a standard, integrated Fire Alarm Interface (FAI). The power supply shall provide capability for secondary voltage, power distribution, direct lock control and network monitoring through add on modules. The power supply shall be expandable up to 16 individually protected outputs. Output modules shall provide individually protected, continuous outputs and/or individually protected, relay controlled outputs. Network modules shall provide remote monitoring functions such as status reporting, fault reporting and information logging.

1. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
2. Manufacturers:

a. Securitron - AQL Series.
b. Schlage/Von Duprin - PS900 Series

2.19 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.

2.20 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

2.21 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.

2.22 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

2.23 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.

2.24 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.

2.25 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.

2.26 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.

2.27 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

2.28 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. Insulating glass units.

C. Two-way mirror glass units.

D. Glazing compounds.

1.02 RELATED REQUIREMENTS

A. Section 07 25 00 - Weather Barriers.

B. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

C. Section 08 14 16 - Flush Wood Doors: Glazed lites in doors.

D. Section 08 43 13 - Aluminum Storefronts and Entrances: Glazing provided as part of storefront assembly.

E. 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 C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass 2021a.

I. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings 2016.

J. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation 2019.

K. GANA (GM) - GANA Glazing Manual 2022.

L. GANA (SM) - GANA Sealant Manual 2008.

M. GANA (LGRM) - Laminated Glazing Reference Manual 2019.

N. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

O. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use 1990 (2016).

P. ITS (DIR) - Directory of Listed Products; Current Edition.

Q. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

R. NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies; 2022.

S. NFRC 100 - Procedure for Determining Fenestration Product U-factors 2023.

T. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence 2023.

U. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems 2023.

V. UL (DIR) - Online Certifications Directory; Current Edition.

W. UL 9 - Standard for Fire Tests of Window Assemblies; Current Edition, Including All Revisions.

X. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

Y. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

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 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.

1.07 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), 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.

1.08 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.

1.09 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 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Design Pressure: See Structural Drawings for further information.
   2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
   4. Glass thicknesses listed are minimum.

B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
   1. In conjunction with weather barrier related materials described in other sections, as follows:
      a. Water-Resistive Barriers: See Section 07 25 00.

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
   1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   3. Solar Optical Properties: Comply with NFRC 300 test method.

D. Insulating Glass shall comply with ASTM D2190 Standard Specification for Insulating Glass Unit Performance and Evaluation. Unit shall be certified for compliance by the IGCC.

E. Unit Overall Thickness Tolerance: - 1/16" / + 1/132".

F. Comply with ASTM E546 Standard Test Method for Frost Point of Sealed Insulating Glass Units and ASTM E576 for insulating glass units in the vertical position.

G. Insulating glass units shall be double sealed with a primary seal of polyisobutylene and a secondary seal of silicone.
   1. Minimum thickness of secondary seal: 1/16".
   2. Target width of primary seal: 5/32".
   3. No primary seal voids or skips allowed.
   4. Gaps or skips between the primary and secondary sealants are permitted to a maximum width of 1/16" by maximum length of 2" with gaps separated by at least 18". Continuous contact between the primary seal and the secondary seal shall be provided.
   5. Primary and secondary sealant adhesion shall exhibit continuous, tenacious adhesion to both glass and spacer contact areas.

2.02 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.

2.03 INSULATING GLASS UNITS AND INSULATED INFILL PANELS

A. Insulating Glass Units: Types as indicated.
   1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
   3. Warm-Edge Spacers: Low-conductivity thermoplastic with desiccant warm-edge technology design.
      a. Spacer Width: As required for specified insulating glass unit.
      b. Spacer Height: Manufacturer's standard.
      c. Spacer Color: Black.
   4. Edge Seal:
      a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
   5. Purge interpane space with dry air, hermetically sealed, argon filled.

B. Type IG-1 - Insulating Glass Units: Vision glass, double glazed.
   1. Applications: Exterior glazing unless otherwise indicated.
   2. Space between lites filled with argon.
   3. Outboard Lite: Heat-strengthened float, 1/4 inch thick, minimum.
      a. Tint: Clear.
      b. Coating: SunGuard® SNX 70+, on #2 surface.
   4. ½” Air space, Argon Fill - Warm-edge spacer.
   5. Inboard Lite: Heat-strengthened float, 1/4 inch thick, minimum.

a. Tint: Clear.
6. Total Thickness: 1 inch, or as required for design loads.
7. Performance Requirements:
   a. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.237, nominal maximum.
   b. Visible Light Transmittance (VLT): 65.6 percent, nominal.
   c. Shading Coefficient: 0.314, nominal.
   d. Solar Heat Gain Coefficient (SHGC): 0.274, nominal.
   e. Visible Light Reflectance, Outside: 15.4 percent, nominal.
8. Glazing Method: Dry glazing method, gasket glazing.
9. Basis of Design Manufacturer: Guardian Industries Corp.

C. Type IG-2 - Insulating Glass Units: Vision glass, double glazed, safety glazing.
1. Applications: Exterior glazing where safety glazing is required.
2. Requirements: Same as type IG-1. Provide fully tempered safety glass at outboard, and inboard lites.
3. Safety Glazing Requirements: Complies with ANSI Z97.1 - Class A, or 16 CFR 1201 - Category II criteria.
4. Safety Glazing Applications: Provide this type of glazing in the following locations:
   a. Locations required by applicable federal, State, and local codes and regulations.
   b. Locations indicated on the Drawings, as indicated with the Type IG-2 designation.

2.04 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: ½ 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.
   c. Glazing for borrowed lights overlooking Atrium, frame types H2 & H3
      1) Glass panels shall be rigid and able to withstand a linear load of 50 plf in accordance with section 4.5.1.1 of ASCE7 and a horizontal concentrated force of 200 pounds applied on one square foot at any point in the system in accordance with section 4.5.1.1 of ASCE 7. Glazing load capacity shall be

verified by a qualified professional structural engineer employed by the glazing subcontractor, licensed in the State of Rhode Island.

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.

2.05 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. Section 09 68 16 – Sheet Carpeting.

H. 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 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 Cementious 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. 2Summary 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 05 40 00 - Cold-Formed Metal Framing: Exterior wind-load-bearing metal stud framing and exterior sheathing.

B. Section 06 10 54 - Wood Blocking and Curbing: Wood blocking for support of wall-mounted equipment.

C. Section 07 21 00 - Thermal Insulation: Acoustic insulation.

D. Section 07 84 00 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.

E. Section 07 90 05 - Joint Sealants: Sealants.

F. Section 09 30 00 - Tiling: Tile backer board.

G. 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 nch 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 Surfacer: 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 gypum 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 suport 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.
   1. Coordinate with the installation of expansion joint covers. See Section 07 95 13 - Expansion Joint Cover Assemblies.

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 form 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, stackinig 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. Tile and accessories for mortar bed shower floors.

D. Accessories and trim.

E. Sealants at tile joints.

F. 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 A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar 2021.

D. 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).

E. Tile with Modified Epoxy Emulsion Mortar/Grout 1999 (Reaffirmed 2019).

F. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework 2017 (Reaffirmed 2022).

G. 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.

H. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation 2019.

I. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation 2014 (Reaffirmed 2019).

J. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar 2019.

K. ANSI A137.1 - American National Standard Specifications for Ceramic Tile 2022.

L. 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).

M. 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, TC-2, TB-1: ANSI A137.3 Porcelain.
1. Sizes, Shapes and Colors: See Finish Legend.
2. Thickness: 3/8 inch
3. Grout Joint: 1/8 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-3 & TC-4: 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

A. Tile Edge and Floor Transition Trim: 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.

B. Mortar Bed Materials: Pre-packaged mix of Portland cement, sand, latex additive, and water.
1. Products:
    a. LATICRETE International, Inc; LATICRETE 3701 Fortified Mortar Bed.

b. Mapei Corporation; Modified Mortar Bed Mix.
c. Custom Building Products; Thick Bed Bedding Mortar.
d. Substitutions: See Section01 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. Waterproofing Membrane; at Floors and Walls: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
1. Application: Wall in showers and shower bench area and waterproofing membrane at bathroom floors except shower areas.
2. Crack Resistance: No failure at 1/8 inch gap, minimum; comply with ANSI A118.12.
3. Fluid or Trowel Applied Type:
a. Material: Synthetic rubber or Acrylic.
b. Thickness: 25 mils, minimum, dry film thickness.
c. Products:
1) LATICRETE International, Inc; LATICRETE HYDRO BAN.
2) Mapei; Mapelastic AquaDefense.
3) Custom Building Products; RedGard Crack Prevention and Waterproofing Membrane.
4) Substitutions: See Section 01 60 00 - Product Requirements.

B. Shower Pan Liner; Under Thick Mortar Bed at Showers:
1. Material: Chloraloy sheet, 40 mils thick, minimum; complying with ASTM D4068.
a. Provide preformed sloped base under membrane, preformed corners, weap hole protectors, seam sealant and other accessories as recommended by manufacturer.
2. Products:
a. Noble Company; Chloraloy Shower Pan Liner.
b. Oatey; CPE Shower Pan Liner.
c. Substitutions: See Section01 60 00-Product Requirements.

C. Preformed Sloped Base; Under Shower Pan Liner at Showers:
1. Material: Polyvinyl chloride sheet, 40 mils thick, minimum; complying with ASTM D4068.
2. Slope: Minimum ¼ inch per foot.
3. Compressive Strength, ASTM D1621: greater than 500 psf.
4. Products:
a. Noble Company; Pro-Slope.
b. Oatey; Perfect Slope.
c. Substitutions: See Section 01 60 00-Product Requirements.

D. Reinforcing Mesh: 2 by 2 inch size weave of 16/16 wire size; welded fabric, galvanized.

E. 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 Levelex Plus.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

F. 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.

G. Solid Surface Thresholds: Beveled edge on both long edges; without holes, cracks, or open seams.
1. Material: Solid surface acrylic resin, mineral filler, and pigments; non-porous, color and pattern consistent throughout thickness.
2. Thickness: 1/2 inch. If thickness is not available provide minimum thickness and feather cementitious underlayment to provide an ADA compliant threshold.
3. Width: 2 inch.
4. Length, as required for opening, single piece.
5. Bevel: Double bevel, maximum ¼ inch 2:1 bevel, ADA compliant.
6. Color and Pattern: As selected by Architect.
7. Product:
    a. Grifform Innovations; TT2 Standard Thresholds.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

H. Mesh Tape: 2 inch wide self-adhesive fiberglass mesh tape.

I. Tile and Grout Cleaners / Sealers: As recommended by the tile and grout manufacturers.

J. 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.

K. 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. Install non-ceramic trim in accordance with manufacturer's instructions.

G. Install thresholds where indicated.

H. Sound tile after setting. Replace hollow sounding units.

I. Keep control and expansion joints free of mortar, grout, and adhesive.

J. 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.

K. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

L. Grout tile joints. Epoxy grout shall be removed from tile surfaces immediately during grouting operations.

M. 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.

N. 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 waterproofing membrane, epoxy bond coat and epoxy grout, unless otherwise indicated. Lap waterproofing membrane 4” up walls where walls are not indicated to be waterproofed.

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 INSTALLATION – SHOWER FLOORS AND WALLS

A. At tiled showers, install in accordance with TCNA (HB) Method B415, mortar bed floor, and W244C, thin-set over cementitious backer unit walls with epoxy bond coat and epoxy grout with waterproofing membrane, unless otherwise indicated. Install using this method at all floors with recessed concrete floors to receive mud bed and all walls adjacent to these floors (shower and bench areas in rooms SHOWER/TLT 104B and SHOWER/TLT 102B. Install shower pan membrane in accordance with manufacturer's instructions. Special attention shall be given to floor drain/shower pan seal. Provide accessories to maintain weep protection at floor drain.

B. Final tile surface shall be sloped a minimum of ¼ inch per foot to floor drains.

3.07 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.

3.08 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.

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. 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.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. 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: 3/4 inch.
   4. Light Reflectance: 88 percent, determined in accordance with ASTM E1264.
   5. NRC Range: 0.75, determined in accordance with ASTM E1264.
   6. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
   7. Panel Edge: Tegular.
   8. Color: White.
   9. Suspension System:
      a. ACT-1: Type 1: Exposed grid.
   10. Products:
      a. Armstrong World Industries, Inc; Ultima 1910.
      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 XX.
      a. Form: A1.2, water felted.
      b. Pattern: "E" - lightly textured.

2. Size: 24 by 24 inches.
3. Thickness: 5/8 inch.
4. Light Reflectance: 86 percent, determined in accordance with ASTM E1264.
5. NRC Range: 0.70, determined in accordance with ASTM E1264.
6. Ceiling Attenuation Class (CAC): 38, determined in accordance with ASTM E1264.
7. Panel Edge: Square.
8. Other Properties:
   a. Anti-mold/mildew composition.
   b. Sag resistant.
9. Color: White.
10. Suspension System Type 1: Exposed grid, typical. Type 2 in shower areas.
11. Products:
    a. Armstrong World Industries, Inc; Ceramaguard, Unperforated 605.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

E. Acoustical Panels, Type ACT-2: Mineral fiber with membrane-faced overlay, with the following characteristics:
1. Classification: ASTM E1264 Type XX.
   a. Form: A1.2, water felted.
   b. Pattern: "E" - lightly textured.
2. Size: 24 by 24 inches.
3. Thickness: 5/8 inch.
4. Light Reflectance: 86 percent, determined in accordance with ASTM E1264.
5. NRC Range: 0.70, determined in accordance with ASTM E1264.
6. Ceiling Attenuation Class (CAC): 38, determined in accordance with ASTM E1264.
7. Panel Edge: Square.
8. Other Properties:
   a. Anti-mold/mildew composition.
   b. Sag resistant.
9. Color: Black.
10. Suspension System Type 1: Exposed grid, typical. Type 2 in shower areas.
11. Products:
    a. Armstrong World Industries, Inc; Ceramaguard, Unperforated 605.

F. 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.

D. Exposed Suspension System, Type 2: Aluminum grid.
   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 Plus 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 CISCA Recommendations For Direct-Hung Acoustical Tile and Lay-in Panel Ceilings, most recent edtion. 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: CISCA 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 ¼" 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. Resilient stair accessories.

E. 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: _20 square feet of each type and color.
   3. Extra Wall Base: _10 linear feet of each type and color.
   4. Extra Stair Materials: Quantity equivalent to 5 percent of each type and color.
   5. 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 STAIR COVERING

A. Stair Treads with Integral Risers, and Matching Tiles, Type RF-3 & RF-4: Rubber; full height of riser, full width and depth of tread in one piece; tapered thickness.
   1. Minimum Requirements: Comply with ASTM F2169, Type TS, rubber, vulcanized thermoset.
   2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
   3. Smoke Density, ASTM E662: Less than 450.
   4. Coefficent of Friction, ASTM D2047 Dry/Wet: 0.99/0.95

5. Nominal Thickness: 0.1875 inch.
6. Size: Full width and depth of stair tread in one piece. Provide equal length units for stairs exceeding manufacturer's maximum manufactured lengths.
7. Nosing: Square, with contrasting integral stripe for the visually impaired.
   a. Striping: 2 inch wide contrasting color abrasive strips.
8. Style: Hammered; Contrasting color abrasive grit strips full width.
9. Landings: Use matching rubber tiles to cover all landings at stair.
10. Tread Texture: Smooth.
11. Color: See Finish Legend.
    a. Colors of substitute products to be custom color if no equal to Basis of Design colors.
12. Warranty: Ten years.
13. Basis of Design Product:
    1) Roppe; Stair Treads.
    b. Acceptable Substitute Products:
    1) Tarkett USA, Inc; Angle Fit Rubber Stair Treads.
    2) Mannington; ColorScape Stair Treads.
    3) Substitutions: See Section 01 60 00 - Product Requirements.

2.04 RESILIENT BASE

A. Resilient Base - Type WB-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:
       1) 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 01 23 00 – Alternates and 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.

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 thicknesss 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 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 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:
      a. Product listing in UL (GGG).

2.02 MATERIALS

A. Tile Carpeting, Type FC-3: 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: 19.69 by 19.69 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. Basis of Design Product:
      a. Interface; Come and Go.
         1) Substitutions: See Section 01 60 00-Product Requirements.
            (a) 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 68 16
SHEET CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet, direct-glued.

1.02 RELATED REQUIREMENTS

A. Section 09 05 61 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.

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

1.03 REFERENCE STANDARDS

A. CRI 104 - Standard for Installation of Commercial Carpet; 2018.

B. CRI (GL) - Green Label Testing Program - 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 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. Shop Drawings: Indicate seaming plan, method of joining seams, direction of carpet pile and pattern.

E. Samples: Submit two samples 12 by 12 inch in size illustrating color and pattern for each carpet and cushion material specified.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional requirements.
   2. Extra Carpet: 20 sq ft of each type, color, and pattern installed.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet with minimum ten years experience.

B. Installer Qualifications: Company specializing in installing carpet with minimum five years experience.

1.07 FIELD CONDITIONS

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).

2.02 CARPET

A. Carpet, Type FC-1, FC-2: Tufted, nylon, abrasive walk-off carpet.
   1. Critical Radiant Flux, ASTM E648 or NFPA 253: Minimum of 0.45 watts/sq cm.
   2. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
   3. Dye Method: 100% Solution Dyed.

4. Roll Width: 6 ft.
5. Face Weight: 24 oz/sq yd.
6. Gauge: 1/12.
7. Stitches: 8.0 per inch.
8. Pile Density: 7,513 oz/cu yd.
9. Primary Backing:
   a. Material: Powerbond.
10. Seams: Adhesive/chemical weld.
11. Color: See Finish Legend.
12. Basis of Design Product:
    a. Tarkett; Abrasive Action II.
       1) Substitutions: See Section 01 60 00-Product Requirements.
          (a) All substitutions must be submitted to Architect during bidding for Architect and Owner approval.

2.03 ACCESSORIES

A. Subfloor Patching Compounds: See Section 09 05 61 - Common Work Results for Flooring Preparation.

B. Slab Moisture Barrier System: See Section 01 23 00 – Alternates and 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

E. Seam Adhesive: Recommended by carpet manufacturer.

F. Flooring Transitions:
   1. Colors and Finishes: See Finish Legend.
   2. Products: See Finish Legend.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive carpet.

B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesives to subfloor surfaces.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
   1. Test in accordance with Section 09 05 61.
   2. Conduct tests by an independent testing agency acceptable to Owner.
      a. See Section 09 05 61.
   3. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
   4. Follow moisture and alkalinity remediation procedures in Section 09 05 61.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

C. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.

D. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

E. Clean substrate.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet in accordance with manufacturer's instructions and CRI 104 (Commercial).

C. Verify carpet match before cutting to ensure minimal variation between dye lots.

D. Lay out carpet and locate seams in accordance with shop drawings.
   1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
   2. Do not locate seams perpendicular through door openings.
   3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
   4. Locate change of color or pattern between rooms under door centerline.
   5. Provide monolithic color, pattern, and texture match within any one area.

E. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.

3.04 DIRECT-GLUED CARPET

A. Cut seams in accordance with manufacturer instruction, with accurate pattern match. Make cuts straight, true, and unfrayed.

B. Apply contact adhesive to floor uniformly at rate recommended by manufacturer. After sufficient open time, press carpet into adhesive.

C. Apply seam adhesive to the base of the edge glued down. Lay adjoining piece with seam straight, not overlapped or peaked, and free of gaps.

D. Roll with appropriate roller for complete contact of adhesive to substrate.

E. Trim carpet neatly at walls and around interruptions.

3.05 CLEANING

A. See Section 01 78 00 - Project Closeout for additional requirements.

B. Remove excess adhesive from floor and wall surfaces without damage.

C. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 72 60
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.
   1. Provide graphic from graphic designer for review.

E. Samples: Submit confirmation samples of wall covering, 12 x 12 inch in size illustrating selected colors, finishes, and textures.
   1. Submit sample of trim, tray and end caps.

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: 25 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. Mainatain 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, Custom image.
   1. Comply with ASTM F793/F793M, Category V, Type II.
   2. Graphic design by contractor hired graphic designer.
   3. 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 5 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 91 130 – 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 13
EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. Exposed surfaces of steel lintels and ledge angles.
   2. Steel equipment and pipe supports
   3. Structural steel, miscellaneous metals.
   4. Existing clay masonry.

D. Verification of compatibility of shop primers (mechanical equipment, structural steel, steel fabrications, etc.) with finish coatings specified herein.

E. 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, and operating parts of equipment.
   5. Non-metallic roofing and flashing.
   6. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, zinc, and lead.
   7. Floors, unless specifically indicated.
   8. Brick, glass unit masonry, architectural concrete, cast stone, integrally colored plaster and stucco.
   9. Glass.
   10. 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 91 23 - Interior Painting.

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

E.

1.03 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.

1.04 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 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(s) product is to be used in; include description of each system.

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 paper paper chip samples, 4 by 4 inch in size illustrating range of colors and textures available for each surface finishing product scheduled.

E. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

F. Manufacturer's Instructions: Indicate special surface preparation procedures.

G. 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.

H. 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 gallon of each color; from the same product run, store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.06 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.

1.07 PRE-INSTALLATION MEETING

A. A pre-installation meeting at least two weeks before start of painting 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.

1.08 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.

1.09 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Paint manufacturer substitutions shall be of a the same MPI-approved system as the specified Basis-of Design system.

C. Paints:
   1. Basis of Design: Sherwin-Williams Company.
   2. Acceptable Manufacturers:
      a. Benjamin Moore
      b. Glidden Professional.
      c. PPG Paints.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

D. Primer Sealers: Same manufacturer as top coats.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless required 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 described explicitly 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. SCAQMD 1113 Rule.
c. CARB (SCM).
d. Architectural coatings VOC limits of 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. Architect to select colors not indicated on Finish Legend or other portions of the Drawings.

2.03 PAINT SYSTEMS - EXTERIOR

A. Metal: Aluminum, Galvanized.
1. Alkyd Systems, Water-Based:
a. Semi-Gloss Finish:
1) 1st Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series, MPI #107. 5 mils wet, 2 mils dry per coat.
2) 2nd and 3rd Coat: Sherwin-Williams Sher-Cryl HPA Acrylic Semi-Gloss, B66-350 Series. 6 to 10 mils wet, 2.0 to 3.3 mils dry per coat.

B. Metal, MiscellaneousHollow metal doors and frames, ferrous metal.
1. Alkyd Systems, Water-Based:
a. Semi-Gloss Finish:
1) 1st Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series, MPI #107. 5 mils wet, 2 mils dry per coat.
2) 2nd and 3rd Coat: Sherwin-Williams Sher-Cryl HPA Acrylic Semi-Gloss, B66-350 Series. 6 to 10 mils wet, 2.0 to 3.3 mils dry per coat.

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

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 surfaces shall be prepared in strict accordance with the manufacturer's printed instructions.

C. Do not begin application of paints and finishes until substrates have been properly prepared.

D. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

E. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

F. Test shop-applied primer for compatibility with subsequent cover materials.

G. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Concrete: 12 percent.
2. Fiber-Cement Board: 12 percent.
3. Masonry (Clay and CMU): 12 percent.
4. Wood: 15 percent.

5. Portland Cement Plaster: 12 percent.
6. Gypsum Board: 12 percent.

3.02 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. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. 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.

G. 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 according to SSPC-SP 6 Commercial Blast Cleaning. Protect from corrosion until coated.

H. Metal Doors to be Painted: Reprime factory primed metal doors with specified primer, including top and bottom edge surfaces.

I. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

J. Non-compatible Shop Primers: Cover with suitable barrier coat or remove primer and reprime as required.
   1. Testing: Apply a test patch of the new painting system to test for adhesion. Allow to dry one week before testing per ASTM D3359. If new painting system lifts, completely remove the existing finish.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions.

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance.

E. Sand wood and metal surfaces lightly between coats to achieve required finish.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field testing.

B. If test results show material being used does not comply with the specified requirements, the Contractor may be directed to stop painting, remove non-complying paint, pay for testing and repaint surfaces coated with the rejected product.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

A. Protect finishes until completion of the Project.

B. Touch-up damaged finishes after Substantial Completion.

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. Brick masonry and precast concrete, unless specifically indicated.
   8. Floors, unless specifically indicated.
   9. Ceramic and other tiles.
   10. Glass.
   11. Acoustical materials, unless specifically indicated.
   12. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 03 35 11 – Concrete Floor Finishes – Concrete floor sealer and coatings, and concrete stains.

B. Section 05 50 00 - Metal Fabrications: Shop-primed items.

C. Section 05 51 00 - Metal Stairs and Railings.

D. Section 08 11 13 – Hollow Metal Doors and Frames.

E. Section 09 21 16 – Gypsum Board Assemblies.

F. Section 09 91 13 - Exterior Painting.

G. 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 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.

1.05 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 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.
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. Metal, Overhead:
1. Metal, Galvanized, Aluminum, Ferrous:
a. Application: Overhead exposed metal deck and ductwork. Provide at ceiling areas
b. Dryfall Waterborne Topcoats:
1) Flat Finish:
(a) 1st and 2nd Coat: Sherwin-Williams Pro Industrial Waterborne Acrylic Dryfall, B42-181 Series, MPI #118.
(1) 6 mils wet, 1.7 mils dry per coat.

D. 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 60 and 10 26 01.
a. 1st coat primer sealer.
1) Verify primer compatibility with protection panel or wall covering manufacturer adhesives.

E. 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.

F. Gypsum Board, Walls and Ceilings, Epoxy, water-based; 1 coat primer, 2 top coats:
1. Application: Gypsum board ceilings in the following locations:
1) All toilet room walls.
2) All shower room walls and gypsum ceilings.
3) EVS room walls.
4) Other locations where indicated on Drawings/Finish Legend.
b. Eg-Shel/Low Luster 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 Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45 Series, MPI #139.
(a) 4 mils wet, 1.5 mils dry per coat.

G. Gypsum Board, Ceilings, Latex; 1 coat primer, 2 top coats:
1. Application: Typical gypsum board ceilngs 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 00
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 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 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.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum ten years documented experience.

1.07 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.

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 REGULATORY REQUIREMENTS

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

1.04 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.

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.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements of ANSI/ICC A117.1 and ADAAG.

1.06 WARRANTY

A. See Section 01 78 10 - Warranties, for term and other warranty requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Inspect products upon receipt. Store products in manufacturer's packaging until ready for installation.

1.08 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. Basis of Design: As provided by owners vendor.
   2. Type: Three-in-one construction without borders; photopolymer signs with lettering and symbols raised 1/32 inch from sign plate face.

3. Sign Thickness: 1/8 inch thick or 1/4 inch thick as required.
4. Construction: One-piece; added-on or engraved characters not acceptable.
5. Lettering Style: Helvetica Medium, upper case.
6. Braille: Grade 2 Braille, placed directly below last line of letters or numbers.
7. Performance: Non-static, fire-retardant, and self-extinguishing.
8. Contrast: Letters numbers and symbols shall contrast with background.
9. Corners: Square.
10. Color of Plastic: As selected from manufacturer's standard colors.
11. Finish of Plastic: Matte.
12. Color of Background: As selected from manufacturer's standard paint colors.
13. Letter and Number Sizes:
    a. Room numbers and text, 7/8 inch high.
    b. Lettering for exit signs, 2 inches high.
14. Sign Margins: Letters and numbers, 1/2 inch left margin and 3/8 inch top margin.
15. 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. All doors shall have one sign with text of room name and room number unless otherwise noted below.
2. 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.
3. Sprinkler Equipment Rooms, Mechanical, and Electrical Rooms: Room name sign.
4. Building Entrances: Where not all building entrances are accessible, provide the following signs:
    a. At Accessible Entrances: International Symbol of Accessibility, with text “Entrance”.
    b. At Non-accessible Entrances: “Entrance” text with directional arrow to accessible entrance.
5. Exits: All doors with lighted exit signs shall be identified by "Exit” text signs. See Electrical Drawings for locations of lighted exit signs.
    a. At exits not part of an accessible means of egress provide a sign indicating the location of the accessible exits.

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, 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 13
PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solid plastic toilet compartments.

B. Urinal screens.

1.02 RELATED REQUIREMENTS

A. Section 06 10 54 - Wood Blocking and Curbing: Concealed wood blocking.

B. Section 10 28 00 - Toilet and Accessories: Accessories mounted on compartments.

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

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

C. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2024.

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: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on panel construction, hardware, 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: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

E. Samples: Submit one set of samples of partition panel material, 3 x 3 inch in size illustrating panel finish, color, and sheen. Submit samples of hardware.

F. Manufacturer's Installation Instructions: Indicate special procedures.

1.07 QUALITY ASSURANCE

A. Materials shall meet interior finish classification Class C as tested in accordance with NFPA 286 Standard Method of Test of Surface Burning Characteristics of Building Materials.

1.08 WARRANTY

A. Submit a fifteen (15) year manufacturer's warranty covering all plastic components against breakage, corrosion, and delamination.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Solid Plastic Toilet Compartments:
   1. Scranton Products; Hiny Hiders Partitions (Basis of Design).

2. ASI Global Partitions.
3. Partition Systems International of South Carolina; PolyLife HDPE Toilet Partitions.
4. Substitutions: Section 01 60 00 - Product Requirements.

2.02 PLASTIC TOILET COMPARTMENTS

A. Solid Plastic Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), tested in accordance with NFPA 286; floor-mounted headrail-braced.
   1. Surface Finish: See Finish Legend.
   2. Colors: See Finish Legend.

B. Doors:
   1. Thickness: 1 inch.
   2. Width: 24 inch.
   3. Width for Accessible Compartments: 36 inch, out-swinging.
   4. Height: 62 inches, at 14 inches off the floor.

C. Panels:
   1. Thickness: 1 inch.
   2. Height: 62 inches, at 14 inches off the floor.

D. Pilasters:
   1. Thickness: 1 inch.
   2. Width: As required to fit space; minimum 3 inch.
   3. Pilaster Height: 82 inches.

E. Urinal Screens: Wall mounted with two panel brackets or a continuous U bracket, and for screens wider than 18 inches, provide floor-to-ceiling vertical upright consisting of pilaster anchored to floor and ceiling. Construction shall be the same construction and finish as indicated for partitions.
   1. Urinal Screen Dimensions: 48 inch high by 18 inch deep. Mounted 14 inches above floor.

2.03 ACCESSORIES

A. Pilaster Shoes: Stainless steel, satin finish, 3 inches high; concealing floor fastenings.
   1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster. Shoes shall be anchored to floor with stainless steel fasteners.

B. Head Rails: Extruded aluminum, anti-grip profile.
   1. Size: Manufacturer's standard size.

C. Wall and Pilaster Brackets: Anodized aluminum; manufacturer's standard type for conditions indicated on drawings.
   1. Continuous U type, aluminum.

D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
   1. For attaching panels and pilasters to brackets: Through-bolts and nuts ; tamper proof.

E. Hinges: Aluminum OR Stainless steel, manufacturer's standard finish.
   1. Hinges: Adjustable for door close positioning; two per door. Out-swinging doors shall be adjusted to return to the fully closed position, in-swinging doors shall be adjusted to return to the partially open position.

F. Door Hardware: Stainless steel, manufacturer's standard finish.
   1. Door Latch: Slide type.
   2. Door Strike and Keeper with Rubber Bumper: Mount on pilaster in alignment with door latch.
   3. Provide door pull for outswinging doors. For outswing doors, provide a pull on both sides of the door.

G. Coat Hook: One per compartment, mounted on door.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing. Start of Work constitutes acceptance of job conditions.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions. Conceal evidence of drilling in floors and walls in finish work.

B. Maintain 3/8 to 1/2 inch space between wall and panels and between wall and end pilasters. Maintain 1/4 inch between pilasters and doors.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING AND CLEANING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

D. After completion of installation, clean and polish exposed compartment and screen surfaces. Remove all protective masking and clean surfaces, leaving them free of soil and imperfections.

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 00
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 60 - 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.
   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: Palladium Wall Panels by Inpro.

B. Corner Guards: Type C#A & E#A Surface mounted, glue-on.
   1. Corner: 90 degree square. Note: All corner angles shall be field verified.
   2. Colors: See Finish Legend.
   3. Length: One piece, as indicated on Drawings.
   4. Product: Inpro; Tape On Corner Guard (Without Tape).

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 Inpro; 1400 & 1600 Serie.

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

PPSECTION 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 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. Coordinate the work with the placement of internal wall reinforcement and blocking to receive anchor attachments.

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. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

E. Adhesive: Two component epoxy type, waterproof.

F. 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 1G - 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 3A – Combination Towel Dispenser & Waste Receptical: Recessed mounted:
   1. Products: B-3940 by Bobrick.

E. Item 6A Napkin Disposal Receptacle: Surface mounted, Stainless steel, welded.
   1. Products: B-270 by Bobrick.

F. 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.

G. Item 8A Shelf: Surface mounted, Stainless steel, welded. 16 inch length
   1. Products: B-295x16 by Bobrick.

H. Item 10C - Soap Dispenser: Surface-mounted.
   1. Furnished by Owner, installed by Contractor.

I. Item 11A - Robe Hook: Heavy-duty stainless steel, single-prong, round-shaped bracket and backplate for concealed attachment, satin finish.
   1. Products: B-542 by Bobrick.

J. Item 13B,13D &13E – 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: B6806 Series by Bobrick.

K. Item 18B – Folding Shower Seat: Wall-mounted surface; welded tubular seat frame, structural support members, hinges and mechanical fasteners of Type 304 stainless steel, square-shaped; supports concentrated force of 360 pounds applied at any point in any direction. Phenolic or polymeric composite one-piece seat or seat slats, of white color.
1. Product: B-5193 by Bobrick.

L. Item 21A – Shower Curtain Rod, Hooks and Curtain: Surface mounted. Lengths as indicated on Drawings.
1. Products: B-204-1, B-204-2 & B-204-3 by Bobrick.

M. Item 22A – Baby Changing Station: Recess mount, stainless steel finish.
1. Product: KB310-SSRE by KoalaKare.
2. Substitutions: See Section 01 60 00 - Product Requirements

N. Item 100 - Sharps Container: Surface mounted.
1. Product: Furnished by Owner and installed by Owner.

O. Item 102B - Glove Dispenser: Surface mounted.
1. Product: Furnished by Owner and installed by Contractor.

P. 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.

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:
a. JL Industries; Ambassador Series #C1017 with FX2 option in fire rated walls.
b. Substitutions: See Section 01 60 00 - Product Requirements.

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 10 51 29
PHENOLIC LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Phenolic lockers.

B. Locker benches.

1.02 RELATED REQUIREMENTS

A. Section 06 10 54 – Wood Blocking and Curbing: Wood base construction.

B. Section 06 20 00 - Finish Carpentry & Architectural Millwork: Bench tops for locker bench support brackets.

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

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

C. 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: Manufacturer's published data on locker construction, sizes 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: Indicate locker plan layout, numbering plan.

E. Full Size Sample: One full-size locker of each construction specified for evaluation of construction.

F. Samples: Submit two samples 3 by 6 inches in size, of each color selected.

G. Manufacturer's Installation Instructions: Indicate component installation assembly.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect locker finish and adjacent surfaces from damage.

PART 2 PRODUCTS

2.01 LOCKER APPLICATIONS

A. Custom Open-Front Athletic Lockers: Phenolic lockers, free-standing with matching closed base.
   1. Accessibility:
      a. Comply with ICC A117.1 and ADA Standards.
      b. Provide two loose wardrobe rails, and 4 loose coat hooks for owner field conversion of lockers.
   2. Width: 24 inches.
   3. Depth: 20 inches.
   4. Height: 82 inches.
   5. Fittings: Size and configuration as indicated on drawings.
      a. Divided upper cubby, half open cubby, half lock box.

1) Lock Type:
(a) As Selected by owner.
b. Name plate holder.
c. Coat rod.
d. Hooks: Two single prong.
e. Fixed seat with open cubby.
6. Basis of Design Manufacturer:
a. Hollman Inc.; Genesis Series.
b. Acceptable Substitute Manufacturers:
1) Columbia Lockers, a division of PSiSC
2) Grid.
3) Substitutions: See Section 01 60 00 - Product Requirements.

B. Locker Benches: Stationary type; bench top of hardwood; painted steel pedestals.
1. Accessibility: Comply with ICC A117.1 and ADA Standards.
2. Height: 18 inch.
3. Length: 42 inch.
4. Depth: 20 inch.
5. Bench Material: ¾ inch phenolic sheet.
a. Color: As selected by Architect..
6. Product:
a. Hollman Inc.; Hilo Bench.
b. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PHENOLIC LOCKERS

A. Lockers: Factory assembled, made of phenolic core panels with mortise and tenon joints and stainless steel mechanical joint fasteners; fully finished inside and out; each locker capable of standing alone.
1. Panel Core Exposed at Edges: Machine polished, without chips or tool marks; square edge unless otherwise indicated.
2. Where locker ends or sides are exposed, finish the same as fronts or provide extra panels to match fronts.
3. Body Color: As selected by Architect; allow for 2 different colors.
4. Fasteners for Accessories and Locking Mechanisms: Tamperproof type.

B. Component Thicknesses:
1. Locker Body: One of the following combinations:
a. Tops, bottoms, and shelves 1/2 inch; sides 3/8 inch; backs 5/16 inch; minimum.
2. End Panels and Filler Panels: 1/2 inch minimum thickness.
3. Toe Kick Plates: 1/2 inch minimum thickness.

C. Phenolic Core Panels: Nonporous phenolic resin and paper core formed under high pressure, with natural colored finished edges, integral melamine surface, matte finish, and uniform surface appearance; glued laminated panels not acceptable.
1. Surface Burning Characteristics: Flame spread index of 75 or less, and smoke developed index of 450 or less; when tested in accordance with ASTM E84.

D. Coat Hooks: Stainless steel; attached with tamperproof screws.

E. Number Plates: Manufacturer's standard, minimum 4-digit, field installed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared bases are in correct position and configuration.

B. Verify bases and embedded anchors are properly sized.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Place and secure on prepared base.

C. Install lockers plumb and square.

D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 pounds.

E. Bolt adjoining locker units together to provide rigid installation.

F. Install end panels, filler panels, and sloped tops.

G. Install accessories.

H. Replace components that do not operate smoothly.

3.03 CLEANING

A. Clean locker interiors and exterior surfaces.

SECTION 10 82 13
ROOFTOP EQUIPMENT SCREENS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rooftop equipment screens for enclosing roof top mechanical equipment.
   1. Aluminum

B. Aluminum Support Framing: For direct attachment of screening panels to mechanical equipment; no base or curb required unless shown otherwise on drawings.

C. Sliding Panels: For access to mechanical equipment for servicing.

D. Not Included in This Specification:
   1. Touch-up painting required for scratches and screw heads.
   2. Field painting of prime painted screens.

1.02 RELATED REQUIREMENTS

A. Section 01 23 00 - Alternates. For direction regarding bidding of screens as alternates.

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

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM): ASTM B 221 - Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire Profiles, and Tubes.

B. The Aluminum Association, Inc. (AA): AA ADM-1516166 - Aluminum Design Manual

C. American Society of Civil Engineers (ASCE): ASCE 7-18 - Minimum Design Loads for Buildings and Other Structures

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. Submit under provisions of Section 01 30 00.

B. Product Data:
   1. Manufacturer's data sheets on each product to be used.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Typical installation methods.
   5. Sufficient data and detail to indicate compliance with these specifications.

C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.

D. Verification Samples: Two representative units of each panel type.
   1. Color Selection: Submit paint chart with full range of colors available for Architect's selection. Custom color samples available upon purchase.

E. Shop Drawings: Indicate layout heights, component connection details, and details of interface with adjacent construction.
   1. Roof top mechanical equipment to be enclosed.

F. Certification: Manufacturer's Certificate of Compliance certifying that panels supplied meet or exceed requirements specified.
   1. Professional Engineer stamped drawings.

G. Closeout Submittals: Warranty documents, issued and executed by manufacturer, countersigned by Contractor.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum of one year documented experience.

B. Installer Qualifications: Company specializing in performing Work of this section with minimum two years documented experience with projects of similar scope and complexity.

C. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

1.07 PRE-INSTALLATION CONFERENCE

A. Convene a conference approximately two weeks before scheduled commencement of the Work. Attendees shall include Architect, Contractor and trades involved. Agenda shall include schedule, responsibilities, critical path items, and approvals.
   1. Notify Architect four (4) calendar days in advance of scheduled meeting date.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

B. Storage and Handling: Protect materials and finishes during handling and installation to prevent damage.

C. Protect from damage due to weather, excessive temperature, and construction operations.

1.09 PROJECT 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 recommended limits.

B. Field Measurements: Take measurements of supporting paving, footings, or piers. Indicate measurements on shop drawings fully documenting any field condition that may interfere with the screen system installation.

1.10 COORDINATION

A. Installer for work under this Section shall be responsible for coordination of panel and framing sizes and required options with the Contractor's requirements.
   1. Request information on sizes and options required from the Contractor.

B. Submit shop drawings to the Contractor and obtain written approval of shop drawing from the Contractor prior to fabrication.

1.11 WARRANTY

A. Warranty: Provide manufacturer’s standard limited 3 year warranty, starting from the date of substantial completion of the project.

B. This warranty does not cover failure of your rooftop equipment screen if the Owner damages it, or if the failure is caused by improper installation. In no event shall the Warrantor be liable for incidental or consequential damages.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer: CityScapes International Inc.
   1. Substitutions: Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE AND DESIGN REQUIREMENTS

A. Regulatory Requirements: Comply with requirements of building authorities having jurisdiction in Project location.

B. Design Criteria:

1. Rooftop Equipment Screens:
    a. The manufacturer is responsible for the structural design of all materials, assembly, and attachments to resist snow, wind, suction, and uplift loading at any point without damage or permanent set.
    b. Framing shall be designed in accordance with the Aluminum Design Manual to resist the following loading:
        1) ASCE 7-18 - Minimum Design Loads for Buildings and Other Structures; American Society of Civil Engineers.
    c. Default Clear Space Between Equipment and Screen: Confirm with approvel RTU sumittal manufacturer.
    d. Standard Truss Sizes: 36 and 48 inch (914 and 1219 mm).
    e. Screen Heights: 35, 52, and 70 inches (889, 1321, 1778 mm) and may be stacked as needed.
    f. Corners may have one panel mounted at 45 degrees.
    g. Screens may partially surround units, but shall obscure view from street level for all possible views.
    h. Trusses: Should be spaced no further than 96 inches (2438 mm) along cabinet perimeter.
    i. Screens Mounted to Steel Posts: Posts must be set no further than 96 inches (2438 mm) on center.
2. Design Requirements to be Supplied to Manufacturer:
    a. Obstructions above unit base rail elevation and within 72 inches (1829 mm) of unit must be identified.
    b. Access panels, access doors, vent hoods, power disconnects, etc. must be accounted for in design; clearly noted on unit cut sheets or roof plans provided to Manufacturer.
    c. Equipment Obstruction Details Provided to Cityscapes: Such as door swings, horizontal ducting, or piping may be made to run between top and bottom rails. Contact Manufacturer for custom solutions.
    d. Post Mounting Systems: By others. Must have all steel sizing provided.
3. Limitations:
    a. Screens may be designed 22 to 60 inches (559 to 1524 mm) clear, as decided necessary by Manufacturer.
        1) Requests for special clearances should be noted.
    b. Screen Heights:
        1) Cannot exceed 8 inches (203 mm) more than cabinet height.
        2) Units may have varying screen heights if needed to clear obstructions such as parapet walls.
    c. Top Trim: May be added to cover as much of the unit above attachment points.
    d. Screen Supports: To be attached below any drip edges.
    e. Spans Between Supports Larger than 100 inches (2540 mm): May require a post mount support.
        1) Free-standing support posts provided by Manufacturer.
    f. Removable Screen Sections:
        1) May be used for large maintenance clearances under special conditions:
        2) Removable Sections:
            (a) Fit between two trusses.
            (b) Are not adjacent to one another; two trusses either side of section.
            (c) Are not placed on the ends of partially sided systems.
    g. Units May be Nested Together If:
        1) Cabinets are suitable for screen attachment.
        2) Cabinets are no further than 96 inches (2438 mm) apart.

3) Units have similar cabinet and curb heights.
4) Units are not on isolation/vibration curbs.

h. If nested look is desired but not possible for one of the reasons above, independent screens can be sized to fit together with small gaps.

2.03 MATERIALS

A. Powder Coated or Painted Metal Panels: Fabricated from rigid aluminum panels in multiple thicknesses.
1. Minimum Thickness: 0.050 inches (1.27 mm).

B. Perforated Metal Panels: Fabricated from rigid aluminum panels in multiple thicknesses.
1. Minimum Thickness: 0.063 inches (1.60 mm).

C. Framing: Aluminum Plate, Shapes and Bar: ASTM B 221, alloy 6061-T5 or 6063-T5.

D. Threaded Fasteners: Screws, bolts, nut, and washers to be Stainless steel.
1. Corner Assembly Fasteners: No. 12-14 x 1-1/4 inches (32 mm) stainless steel self-drilling screws.
a. Length: As required to develop full holding capacity of screw when fastened to Mechanical Equipment.
2. Provide lock washer or other locking device at all bolted connections.

2.04 FABRICATION

A. Provide factory-formed panel systems with continuous interlocking panel connections and indicated or necessary components: Form all components true to shape, accurate in size, square and free from distortion or defects. Cut panels to precise lengths indicated on approved shop drawings.

B. Fabricate all panels to slide horizontally to allow access to unit access panels behind.

C. Design, and Trim:
1. Panel Design: Metal Series. Vented Louver.
2. Decorative Top Trim Profile: Band.

D. Trim and Closures: Material: Aluminum. Thickness: 0.050 to 0.25 inches (1.27 to 6.35 mm),
1. Finish: Manufacturers standard coating system, unless shown otherwise on drawings.

E. Framing: Fabricate and assemble components in largest practical sizes, for delivery to Project site.
1. Corner Assemblies: Construct to required shape with joints tightly fitted.
2. Components Required Framing Anchorage: Fabricate anchors and related components of material and finish as required, or as specifically noted.

2.05 FINISHES

A. Aluminum Framing: Mill finish.

B. Panel Coating: Manufacturer's standard powder coating system, factory applied.
1. Color: Selected from full range of manufacturer's standard colors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Installer's Examination: Examine conditions under which construction activities of this section are to be performed.
1. Submit written notification to Architect and Screen manufacturer if such conditions are unacceptable.
2. Beginning erection constitutes installer's acceptance of conditions.

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.

3.03 INSTALLATION

A. Install screen systems in accordance with the manufacturer's instructions and approved shop drawings. Keep perimeter lines straight, plumb, and level. Provide brackets, anchors, and accessories necessary for a complete installation.

B. Fasten structural supports to HVAC units without damaging the operation of the unit.
   1. Provide corner and mid-span assemblies as required by approved shop drawings so that the panels are supported uniformly.
   2. Fastening bottom rail using bolts to permit ease of access to HVAC units.

C. Insert panels into structural supports, except where fixed attachment points are indicated. Butt panels to adjacent panels for uniform fit. Fasten fixed panels in accordance with the shop drawings.

D. Metal Separation: Where aluminum materials would contact dissimilar materials, insert rubber grommets at attachment points, thus eliminating where dissimilar metals would otherwise be in contact.

E. Do not cut or abrade finishes which cannot be restored unless instructed. Return items with such finishes to shop for required alterations.

3.04 ERECTION TOLERANCES

A. Maximum misalignment from true position: 1/4 inch (6 mm).

3.05 CLEANING AND PROTECTION

A. Remove all protective masking from material immediately after installation.

B. Protection:
   1. Ensure that the finishes and structure of installed systems are not damaged by subsequent construction activities.
   2. If minor damage to finishes occurs, repair damage in accordance with manufacturer's recommendations; provide replacement components if repaired finishes are unacceptable to Architect.

C. Prior to Substantial Completion: Remove dust or other foreign matter from component surfaces; clean finishes in accordance with manufacturer's instructions.
   1. Clean units in accordance with the manufacturer's instructions.

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:
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. Solid surface countertops.

B. Wall-hung counters.

C. Sinks molded into countertops.

D. Window sills.

1.02 RELATED REQUIREMENTS

A. Section 06 10 54 - Wood Blocking and Curbing: Concealed wood blocking.

B. Section 06 20 00 - Finish Carpentry: Countertop end panels, cleats, support brackets and grommets.

C. Section 06 41 00 - Architectural Wood Casework.

D. Section 10 26 00 – Wall Protection: Solid surface shower base and wall panels.

E. Division 22 - Plumbing: Sinks.

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

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2022.

B. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications; 2022.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.

D. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

F. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

G. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

H. IAPMO Z124 - Plastic Plumbing Fixtures; 2022, with Editorial Revision.

I. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

J. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2024.

K. 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. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
   1. Flat Sheet Thickness: 1/2 inch, minimum.
   2. ISSFA-2 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
      a. Basis of Design Manufacturers:
         1) Dupont; Corian.
      b. Acceptable Substitute Manufacturers:
         1) Formica Corporation.
         2) Wilsonart.
         3) Substitutions: See Section 01 60 00 - Product Requirements.
      c. Fire Resistance, ASTM E84: Flame spread 25, max. Smoke developed 450, max.
      d. NSF approved for food contact.
   3. Other Components Thickness: 1/2 inch, minimum.

4. Exposed Countertop Edge Treatment: Built up to 1-1/2 inch thick; edge profile as indicated on Drawings.
5. Back Splashes: Same sheet material, coved integral to horizontal counter, square top with eased edge; minimum 4 inches high and as indicated on the Drawings.
6. End Splashes and Splashguards: Same sheet material, square top with eased exposed edge; minimum 4 inches high and as indicated on the Drawings.
7. Skirts: As indicated on drawings
8. Sinks and Bowls: Integral casting, undermount; minimum 3/4 inch wall thickness; comply with ANSI Z124.3. Colors as selected by Architect from manufacturer's full range.
    a. Manufacturers and Colors: See Finish Legend.
    b. Basis of Design Products:
        1) Handwashing bowls, 13-7/8 inch by 15-1/4 inch inch interior dimension, with corner offset drain:
            (a) Corian; 8252 Lavatory
            (b) Substitutions: See Section 01 60 00 - Product Requirements.
9. Substrate: See Accessories.

2.02 MATERIALS

A. Counter Substrate: Particle board; ANSI A208.1 Class M2; no urea formaldehyde-added.
1. Application: Counters with no sinks.
2. Density; 38.7 pcf min.
3. Modulus of Elasticity: 290,100 psi minimum.
4. Panel Thickness for Plastic Laminate Facing: 1-1/8 inches.
5. Panel Thickness for Solid Surfacing: 3/4 inches minimum.

B. Counter Substrate: Medium density fiberboard; ANSI A208.2; Grade 130; no urea formaldehyde-added; water resistant.
1. Density: 45 pcf min.
2. Modulus of Elasticity: 405,000 psi minimum.
3. Panel Thickness for Solid Surfacing: 3/4 inches minimum.
4. Product:
    a. Medex; Roseburg.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

C. 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.

D. Joint Sealant: Mildew-resistant silicone sealant, clear. See Section 07 90 05.

E. Grommets: Plastic, 3" outside diameter; colors selected from manufacturer's full color range.
1. Product: TG Flip-Top Series; Doug Mockett Co., Inc.

F. Fixed Countertop Support Brackets: See Section 06 20 00.

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. Solid Surfacing Countertops:
   1. Fabricate tops up to 144 inches long in one piece.
      a. Integral sinks: Shop-mount securely to countertop with adhesives, using flush configuration, as per manufacturer's instructions, and as detailed on drawings.
   2. Join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.
   3. Provide integral coved backsplashes.
   4. Provide separate square edge side splashes.
   5. Provide separated splash guards as indicated on the Drawings.
   6. Located seams at least 3 inches from corners.

E. Plastic Laminate Countertops:
   1. Fabricate up to 10 feet long without joints. Fabricate up to 5 feet wide without joints.
   2. All edges shall be tooled smooth and square.
   3. Provide backer surfacing on non-exposed substrate surfaces for balanced construction.
   4. Where materials meet at edges and corners, joints shall butt and overlapping members shall be filed off smooth, forming a slightly eased joint.
   5. All joints shall be shop-prepared. No joint shall be located within 12 inches of a sink or 3 inches of a corner.

F. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on the Drawings, finished to match.

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. See Section 06 20 00 - Finish Carpentry. 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. Solid Surface Countertops:

1. Secure countertops to cabinets with silicone sealant. Do not use water based adhesives.
2. Provide for 1/32 inch expansion for 8 foot length of counter.
3. Sealant joints shall be 1/8 inch minimum in width.
4. Seam and finish joints as recommended by the manufacturer.

E. Plastic Laminate Countertops:
1. Attach countertops using screws with minimum penetration into substrate board of 5/8 inch.
2. Finish butt seams with matching sealant, as recommended by manufacturer.

F. 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

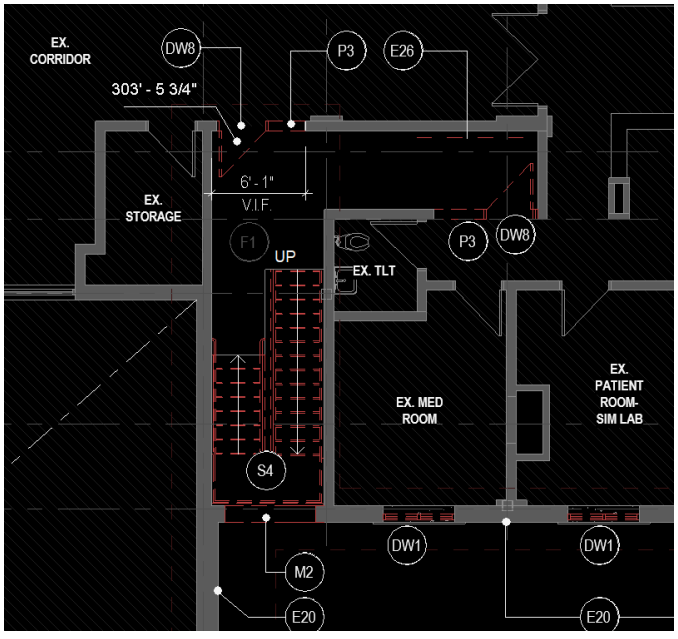
1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. The fire protection system scope shall provide extensions and alterations to the existing wet pipe automatic sprinkler system within the existing building as required to facilitate the new addition and renovations. System design shall be automatic sprinkler system arranged to properly protect the building and shall meet NFPA 13, local, and State requirements. Alterations and extensions to the existing system shall include but not necessarily be limited to the following:

1. Provide full sprinkler coverage for the entire addition to Kirk Hall at Central Maine Community College as part of the CMCC Healthcare Training Expansion that shall meet NFPA 13.
2. Add Alternate #4: Revise the main and branch piping and head layout throughout the second-floor nurse simulation area to facilitate the renovations.
3. Revise and upsize mains as needed in the corridors of both the 1st and 2nd floors to facilitate the renovations and additions to Kirk Hall as part of this project.
4. Provide demolition, alterations and extensions as required at the stairwell and landing areas at the east side of the building (shown below and called out on sheet AD.2) to accommodate the removal of the stairs and addition of a new floor and ceilings.



B. This Section includes fire-suppression sprinklers, piping, and equipment.

C. The Sprinkler Contractor shall place the sprinkler system in service and hand over the sprinkler system to the General Contractor for care and maintenance.

D. Performance and Design Criteria: Provide products and systems complying with specific performance and design criteria indicated.

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. Classrooms – educational
    d. Restrooms
    e. Locker Rooms

2. Ordinary Hazard, Group 1:

    a. General Storage Areas
    b. Mechanical Equipment Rooms
    c. Building Service Areas.

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 and 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. Institutional Semi-Recessed or "Vandal-Resistant" sprinkler heads as required by application.

F. Sprinkler Escutcheons: Materials, types, and finishes of sprinklers. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

G. 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. 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.

PART 3 - EXECUTION

3.01 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.

3.02 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.

3.03 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

1. Unfinished spaces not exposed to view: rough bronze.
2. Recessed Sprinklers: White
3. Provide escutcheons with matching color for finished spaces.

3.04 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. 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.

D. Provide "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13

E. Provide a vent near a high point in the system to allow air to be removed from that portion of the system.

3.05 SPRINKLER INSTALLATION

A. Provide sprinklers in suspended ceiling in center of all ceiling tiles.

B. 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.

C. Provide sprinkler piping with drains for complete system drainage.

D. Hangers and Supports: Comply with NFPA 13 for hanger materials.

3.06 LABELING AND IDENTIFICATION

A. Provide labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

3.07 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.

3.08 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.

3.09 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.

3.10 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 2-1⁄2" to 4" threaded, shall be rated to 400psi WOG non-shock and 125psi WSP. Valve sizes 2-1⁄2" 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 @ 210ºF; 125psi WSP @ 353ºF 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)
3. Watts 957-FS-OSY (2-1/2” and larger)
4. Watts LF909-FS (2" and smaller)
5. Watts LF909-FS-OSY (2-1/2" and larger)

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.

D. Pressure Reducing Valve: A Water Pressure Reducing Valve with integral strainer shall be installed in the water service pipe near its entrance to the building where supply main pressure exceeds 60psi (413 kPa) to reduce it to 50psi (345 kPa) or lower. The water pressure reducing valve shall be constructed using Lead Free* materials. Lead Free* regulators shall comply with state codes and standards, where applicable, requiring reduced lead content. The valve shall feature a Lead Free* cast copper silicon alloy body suitable for water supply pressures up to 300psi (20.7 bar). Provision shall be made to permit the bypass flow of water back through the valve into the main when pressures, due to thermal expansion on the outlet side of the valve, exceed the pressure in the main supply. Water Pressure Reducing Valve with built-in bypass check valves will be acceptable. Approved valve shall be listed to ASSE 1003 and IAPMO and certified to CSA B356. Valve shall be a Watts Series LFU5B-Z3 or approved equal.

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).

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.

D. TMV-1 (Provide at water heater): Hot water tank capacity extender thermostatic mixing valve shall be constructed using Lead Free copper silicon alloy 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 connection 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 thermostatic mixing valve shall be ASSE 1070, ASSE 1017 and IAPMO cUPC listed. Capacity of the valve shall be 13.0 GPM at 45 psi differential. Valve shall perform to a minimum flow of 0.5 GPM to ASSE 1070 and ASSE 1017. Control temperature shall be adjustable between 80° – 120°F (27° – 49°C). The valve shall feature a vandal-resistant lockable handle to prevent tampering. The hot water tank capacity extender shall be Powers' Model LFLM496-HTK, or approved equal.

Typical Installation



E. Circulator pump shall be designed specifically for hot water recirculation applications. Pump shall be by Grundfos, Wilo, Taco, or Bell & Gossett. Provide the following features:

1. Refer to plumbing pump schedule on the plans.
2. Wet rotor design for quiet, maintenance free operation.
3. Stainless Steel rotor cladding and canister construction to prevent corrosion.
4. Composite impeller design for optimal application performance.
5. UL Recognized strain relief and wire connections.
6. Fully UL Recognized.
7. Each unit shall be run and High Pot. tested.
8. Bronze sweat connections.
9. Provide circuit setter for balancing.

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.

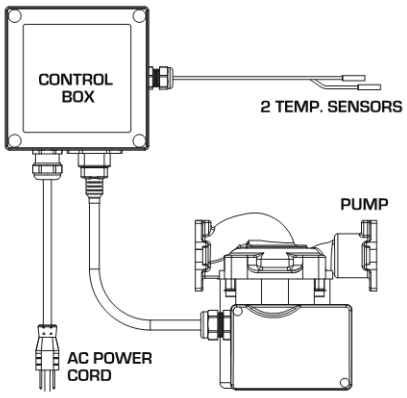
1. Balancing valves shall be self-contained and fully automatic without additional piping or control mechanisms.
2. Balancing valves shall regulate the flow of recirculated domestic hot water based on water temperature entering the valve regardless of system operating pressure.
3. When fully closed valve 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 DHW RECIRCULATION PUMP CONTROLLER

A. Provide the Enovative “Autohot” system, designed to control the hot water recirculation pumps used on a domestic hot water system. System shall be IECC-2021 compliant. The on-demand recirculation control reduces pump runtime by as much as 90% by activating at the time that a hot water draw, or demand is initiated in the building and turning off when there is a temperature rise or a set point achieved on the hot water return line.



B. Recirculation Pump Control
   1. Activation with hot water demand, turn off with temperature rise adjustable between 5°F and 25°F, and set lockout point. Max runtime after activation of 10 minutes.
   2. Auto-prime feature, pulses pump activation based on intervals between 10 minutes and 4 hours.
   3. Onboard dipswitches allow changes to other pump control modes. Modes include on-demand, continuous, temp based, or sensor-based operation

C. Provide a 3-speed Grundfos or Taco pump. Pump shall be compliant with NSF 61 low lead requirements.

MATERIALS OF CONSTRUCTION

DESCRIPTION	MATERIAL	DESCRIPTION	MATERIAL
Inlet Cone, Bearing Plate, Bearing Retainers, Rotor Can, Rotor Cladding Shaft Retainer	304 Stainless Steel	Pump Housing (Volute)	Silicon bronze C875 or Stainless steel 300 series
Stator Housing	Aluminum	O'Ring & Gaskets	EP (Ethylene Propylene Rubber)
Shaft, Upper & Lower Radial Bearings	Aluminum Oxide Ceramic	Impeller	PES Composite (30% Glass Filled)
Thrust Bearing	Carbon bearing and EPDM retainer		
Check Valve	ACETAL with 302 Stainless Steel Spring & Nitrile Rubber Seats	Terminal Box	Noryl®

D. Provide components and installation per manufacturer's instructions, as required for a complete, functioning, IECC-2021 compliant installation.

2.09 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. Mechanical 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 11 23

FACILITY FUEL GAS 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 22 Section: “Common Work Results”

1.02 SUMMARY

A. This Section includes fuel gas piping, specialties, and accessories.

1.03 SUBMITTALS

A. Product Data: For the following:

1. Specialty valves
2. Pressure regulators.
3. Meters

B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

C. Maintenance Data: For fuel gas specialties and accessories to include in maintenance manuals specified in Division 1.

D. Seismic Delegated-Design Submittal:

1. For piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

    a. Determine seismic restraint sizes and locations.
    b. Provide seismic restraints as scheduled or specified.
    c. Provide calculations and materials if required for restraint of un-isolated equipment.
    d. Provide installation instructions, drawings and trained field supervision to insure proper installation and performance.

2. Seismic restraints shall be designed in accordance with seismic force levels as detailed herein.

    a. Applicable Code: IBC
    b. Seismic Design Category: See structural plans.

c. Design Spectral Response at Short Periods (SDS): See structural plans.
d. Short Period Spectral Response Acceleration (SS): See structural plans.
e. Building Use Group or Occupancy Category: See structural plans.

1.04 QUALITY ASSURANCE

A. All work shall be performed by fuel gas licensed technicians.

B. Installations of fuel gas shall comply with the local fuel gas code: Maine Fuel Board Laws & Rules and NFPA 54.

C. Electrical Components and Devices: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. FM Standard: Provide components listed in FM's "Fire Protection Approval Guide" if specified to be FM approved.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Valves:

a. American Valve.
b. Conbraco Industries, Inc.; Apollo Div.
c. Crane Valves.
d. Grinnell Corp.
e. Honeywell, Inc.
f. McDonald: A. Y. McDonald Mfg. Co.
g. Milwaukee Valve Co., Inc.
h. Nibco, Inc.
i. Mueller Co.; Mueller Gas Products Div.
j. Watts Industries, Inc.

2. Pressure Regulators:

a. American Meter Co.
b. Equimeter, Inc.
c. Fisher Controls International, Inc.
d. Maxitrol Co.
e. National Meter.
f. Richards Industries, Inc.; Jordan Valve Div.
g. Schlumberger Industries; Gas Div.

2.02 PIPES, TUBES, FITTINGS, AND JOINING MATERIALS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

    a. Material Group: 1.1.
    b. End Connections: Threaded or butt welding to match pipe.
    c. Lapped Face: Not permitted underground.
    d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
    e. Bolts and Nuts: ASME B18.2.1, carbon steel.

2.03 SPECIALTY VALVES

A. Valves, NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.

B. Valves, NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel flanges.

C. Appliance Connector Valves: ANSI Z21.15 and IAS listed.

D. Gas Stops: Bronze body with AGA stamp, plug type with bronze plug and flat or square head, ball type with chrome-plated brass ball and lever handle, or butterfly valve with stainless-steel disc and fluorocarbon elastomer seal and lever handle; 2-psig minimum pressure rating.

E. Gas Valves, NPS 2 and Smaller: ASME B16.33 and IAS-listed bronze body and 125-psig pressure rating. Tamperproof Feature: Include design for locking.

F. Plug Valves, NPS 2-1/2 and Larger: ASME B16.38 and MSS SP-78 cast-iron, lubricated plug valves, with 125-psig pressure rating. Tamperproof Feature: Include design for locking.

G. General-Duty Valves, NPS 2-1/2 and Larger: ASME B16.38, cast-iron body, suitable for fuel gas service, with "WOG" indicated on valve body, and 125-psig pressure rating. Gate Valves: MSS SP-70, OS&Y type with solid wedge. Butterfly Valves: MSS SP-67, lug type with lever handle.

2.04 FLUSH WALL MOUNT SOLENOID GAS VALVE CONTROLLER

A. Provide where indicated on the Drawings. Equal to ISIMET LA-1212.
1. Dimensions: 16”W x 10”H (panel) and 12.25”W x 6”H x 4”D (wall box).
2. Two output relays: (1) 120Vac for GAS and (1) 120Vac for Electrical shunt trip. Label panel switches “Gas” and “Electric”
3. Solenoid valve: Located remotely and wired to controller.
4. Panel shall have Green LED status light, manual control switches, panic button, and keyed lock.
5. Provide with two optional dry contact outputs.
6. Control Panel finish shall be 16-gauge stainless steel.
7. Wall Box shall be 16-gauge plate sheet metal.

8. All enclosures shall have same key cut.
9. Optional room Gas Detector input.

2.05 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig.
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches

B. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

C. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

D. Pressure gages shall conform to ASME B40.100, Type I, Class 1. Pressure-gage size shall be 3-1/2-inch nominal diameter. Case shall be corrosion-resistant steel conforming to any of the AISI 300 series of ASTM A 666, with a No. 4 standard commercial polish or better. All gages shall be equipped with adjustable red marking pointer and damper screw adjustment in inlet connection.

2.06 PRESSURE REGULATORS

A. Provide service, line, and appliance pressure regulators as indicated and as required by fuel code. Regulators may include vent limiting device, instead of vent connection to outside, if approved by authorities having jurisdiction. Provide venting as required by fuel code.

B. Line Pressure Regulators: ANSI Z21.80 with 10-psig inlet pressure rating, unless otherwise indicated.

C. Appliance Pressure Regulators: ANSI Z21.18.

D. Pressure Regulator Vents: Factory- or field-installed, corrosion-resistant screen in opening if not connected to vent piping.

2.07 SEISMIC RESTRAINTS

A. Seismic-restraint devices shall have horizontal and vertical load testing and analysis performed according to OSHPD and shall bear anchorage preapproval "R" number, from OSHPD or another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If pre-approved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer. Testing and calculations must include both shear and tensile loads and 1 test or analysis at 45 degrees to the weakest mode.

B. Seismic Cable Restraints shall consist of galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all-directional restraint.

C. Seismic solid braces shall consist of steel angles or channels to resist seismic loads with a minimum safety factor of 2 and arranged to provide all directional restraint.

D. Steel angles, sized to prevent buckling, shall be clamped to pipe or equipment rods utilizing a minimum of three ductile iron clamps at each restraint location when required.

E. Pipe clevis cross bolt braces are required in all restraint locations. They shall be special purpose preformed channels deep enough to be held in place by bolts passing over the cross bolt.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine roughing-in for gas piping system to verify actual locations of piping connections before equipment installation.

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

3.02 EARTHWORK

A. Comply with requirements in Division 31 for excavating, trenching, and backfilling.

3.03 PREPARATION

A. Close equipment shutoff valves before turning off fuel gas to premises or section of piping. Perform leakage test as specified in "Field Quality Control" Article to determine that all equipment is turned off in affected piping section. Remove and legally dispose of liquids from drips in existing gas piping. Handle cautiously to avoid spillage and ignition. Notify fuel gas supplier.

B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

C. Inspect gas piping according to fuel gas code to determine that gas utilization devices are turned off in piping section affected.

D. Comply with fuel gas code requirements for prevention of accidental ignition.

E. Make arrangements with local utility for gas service to the Owner's distribution system. Provide service to the building as required by the gas supplier. Coordinate all activities between the Owner and gas supplier. The installation of the gas service shall comply with the published gas supplier standards. Pay all utility company charges; include charges in the base bid.

3.04 PIPING APPLICATIONS

A. Flanges, unions, transition, and special fittings with pressure ratings same as or higher than system pressure rating may be used in applications below, unless otherwise indicated.

B. Fuel Gas Piping: Use the following:

1. NPS 2 and Smaller: steel pipe, malleable-iron threaded fittings, and threaded joints.
2. NPS 2-1/2 and Larger: Steel pipe, steel welding fittings, and welded joints.
3. Gas Service Piping at Meters and Regulators: Steel pipe, steel welding fittings, and welded joints.

C. Concealed (gas piping that, when in place in a finished building, would require removal of permanent construction to gain access to the piping) Locations: Except as specified below, install concealed gas piping in airtight conduit constructed of Schedule 40, seamless, black steel pipe with welded joints. Vent conduit to outside and terminate with screened vent cap.

1. Above-Ceiling Locations: Gas piping may be installed in accessible spaces, subject to approval of authorities having jurisdiction, whether or not such spaces are used as plenums. Do not locate valves above ceilings.
2. In Floors: Not permitted.
3. Concealed piping shall not be installed in solid partitions.
4. Prohibited Locations: Do not install gas piping where not allowed by fuel gas code.
5. In-slab (within building) Fuel Gas Piping: Not permitted.

3.05 VALVE APPLICATIONS

A. Appliance Shutoff Valves for Pressure 0.5 psig or Less: Appliance connector valve or gas stop.

B. Appliance Shutoff Valves for Pressure 0.5 to 2 psig: Gas stop or gas valve.

C. Piping Line Valves, NPS 2 and Smaller: Gas valve.

D. Piping Line Valves, NPS 2-1/2 and Larger: Plug valve or general-duty valve.

E. Valves at Service Meter, NPS 2 and Smaller: Gas valve.

F. Valves at Service Meter, NPS 2-1/2 and Larger: Plug valve.

3.06 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. Drips and Sediment Traps: Provide drips at points where condensate may collect. Locate where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Provide with space between bottom of drip and floor for removal of plug or cap.

C. Provide fuel gas piping at uniform grade of ¼” per 15 feet.

D. Use eccentric reducer fittings to make reductions in pipe sizes. Provide fittings with level side down.

E. Connect branch piping from top or side of horizontal piping.

F. Provide strainer on inlet of each line pressure regulator.

G. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

3.07 SEISMIC RESTRAINT OF PIPING

A. Seismic restraint systems must be installed in strict accordance with the manufacturers written instructions and all certified submittal data.

B. Installation of seismic restraints must not cause any change of position of equipment or piping resulting in stresses or misalignment.

C. Coordinate work with other trades to avoid rigid contact with the building.

D. Overstressing of the building structure must not occur because of overhead support of equipment. Generally bracing may occur from flanges of structural beams, upper truss cords in bar joist construction, or cast in place inserts or wedge type drill-in concrete anchors.

E. Cable restraints shall be installed slightly slack to avoid short-circuiting the isolated suspended equipment, piping or conduit. Cable assemblies shall be installed taut on non-isolated systems. Seismic solid braces may be used in place of cables on rigidly attached systems only.

1. The support rods must be braced when necessary to accept compressive loads with steel angles and rod clamp assemblies.
2. At all locations where restraints are attached to pipe clevis's, the clevis cross bolt must be reinforced with pipe clevis cross bolt braces.
3. Seismically restrain the following piping: Fuel gas piping that is 1" I.D. or larger.
4. Piping exclusions:

a. Gas piping less than 1" inside diameter.
b. All piping suspended by individual hangers 12" or less as measured from the top of the pipe to the bottom of the support where the hanger is attached. However, if the 12" limit is exceeded by any hanger in the run, seismic bracing is required for the run.
c. The 12" exemption applies for trapeze-supported systems if the top of each item supported by the trapeze qualifies.

5. Transverse piping restraints shall be at 20' maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
6. Longitudinal restraints shall be at 80' maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
7. Transverse restraint for one pipe section may also act as a longitudinal restraint for a pipe section of the same size connected perpendicular to it if the restraint is installed within 24" of the elbow or tee or combined stresses are within allowable limits at longer distances.
8. Hold down clamps must be used to attach pipe to all trapeze members before applying restraints in a manner similar to clevis supports.
9. Branch lines may not be used to restrain main lines.

F. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.

3.08 CONNECTIONS

A. Connect piping to appliances using appliance flexible connectors, shutoff valves, and unions. Provide valve upstream from and within 72 inches of each appliance. Provide union downstream from valve.

B. Sediment Traps: Provide tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance using gas.

3.09 PAINTING

A. Comply with requirements in Division 9 for painting interior and exterior fuel gas piping.

B. Paint exposed, exterior metal piping, valves, regulators, service meters and meter bars, and piping specialties, except components with factory-applied paint or protective coating.

1. Alkyd System: MPI EXT 5.1D.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
c. Topcoat: Exterior alkyd enamel
d. Color: As selected by Architect

C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.10 FIELD QUALITY CONTROL

A. Inspect, test, and purge piping according to fuel gas code and requirements of authorities having jurisdiction.

B. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.

C. Report test results promptly and in writing to Architect and authorities having jurisdiction.

D. Verify capacities and pressure ratings of service meters, pressure regulators, valves, and specialties.

E. Verify correct pressure settings for pressure regulators.

F. Verify that specified piping tests are complete.

G. Verify that the gas piping has been grounded by Division 26 in accordance with NFPA requirements.

H. Adjust controls and safety devices. Replace damaged and malfunctioning controls and safety devices.

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 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.

2.06 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 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.

D. 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.

E. Cleanouts shall consist of "Y" fittings and (1/8 inch) bends with brass or bronze screw plugs.

F. 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.

G. 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.

2.07 FLOOR DRAINS

A. Manufacturers

1. Zurn Industries, Inc
2. Jay R. Smith Mfg. Co.
3. Tyler Pipe, Wade Div.
4. Watts Industries, Inc
5. Mifab
6. Wade

B. Floor drains shall comply with ASME A112.21.1M. Provide outlet type as required by piping system used.

C. Provide ½" trap primer connection as indicated on plans.

D. 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: Josam 30000-A
3. Square: Josam 30000-S provide for tile floors.

E. 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.

2.08 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.

2.09 ROOF DRAINS

A. Roof Drains: Comply with ASME A112.21.2M.

B. Manufacturers

1. Zurn
2. Josam Co.
3. Froet Industries
4. Smith, Jay R. Mfg. Co.
5. Tyler Pipe, Wade Div.
6. Watts
7. Mifab

C. Provide collars, clamps, and extensions as required to suit roofing conditions. Provide outlet type as required by piping system used.

D. Provide -F Deck Flange, a bolt down system that secures roof drain assembly integrally to roof deck; combines traditional roof sump receiver with deck clamp to provide a more secure, long lasting installation of the roof drain. Install roof drain from top of roof eliminating costly and dangerous assembly of components from the underside of the roof deck, leaving the pipe connection as the only remaining task from under the roof deck.

E. Standard: Watts RD-300-F or approved equal; Epoxy coated cast iron roof drain with flashing clamp with integral gravel stop, heavy 10 ga. zinc plated steel deck flange and adjustable extension, self-locking polyethylene dome.

F. Overflow Roof Drain: Watts RD-300-F-R or approved equal; Epoxy coated cast iron roof drain with flashing clamp with integral gravel stop, heavy 10 ga. zinc plated steel deck flange and adjustable extension, self-locking polyethylene dome, and outlet with 2" external water dam.

G. Combination Primary and Overflow Roof Drain: Watts RD-350-F2 or approved equal; Epoxy coated cast iron dual outlet roof drain/overflow with flashing clamp, integral gravel stop, 4" high internal overflow standpipe, secured polymer dome, and no hub outlet(s) standard. See drawings for size(s).

H. Outlet Nozzle: Watts RDA-940, Josam 25010-Z, JR Smith 1771 or approved equal; Cast aluminum or bronze Downspout Nozzle with integrated wall flange and vandal proof screws for universal gasketed connection for cast iron, or PVC. Integral perforated hinged bird screen and powder-coated finish. Coordinate color with the architect.

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.

A. Underground, Soil, Waste, and Vent Piping: Use PVC or cast iron.

B. Aboveground Soil, Waste, and Vent Piping: Use cast iron.

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.

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 34 00

FUEL-FIRED, DOMESTIC-WATER HEATERS

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.

1.02 SUMMARY

A. Section includes gas fired domestic hot water heaters.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Include diagrams for power, signal, and control wiring.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.05 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.06 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failures including storage tank and supports.
   b. Faulty operation of controls.
   c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion: 5 years.

PART 2 - PRODUCTS

2.01 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AO Smith
2. Bradford White
3. Viessmann
4. PVI
5. State Industries.

B. The basis of design shall be the Cyclone Gas-Fired Water Heater manufactured by AO Smith or approved equal.

C. Natural gas water heater shall be A. O. Smith Cyclone Flex model #BTH-145A or equal, minimum 95% thermal efficiency, a storage capacity of 60 gallons, an input rating of 145,000 BTUs per hour, a recovery rating of 165 gallons per hour (gph) at 100°F rise and a maximum hydrostatic working pressure of 160 psi. Water heater(s) shall:

1. Adaptive gas controlled modulating gas burner that automatically adjusts the input based on demand.
2. Powered anodes that are non sacrificial and maintenance free.
3. Have seamless glass-lined steel tank construction, with glass liLning applied to all water-side surfaces after the tank has been assembled and welded.
4. Meets the thermal efficiency and/or standby loss requirements of the U. S. Department of Energy and current edition of ASHRAE/IES 90.1.
5. Have 2” foam insulation and a CSA Certified and ASME rated T&P relief valve.
6. Have a down-fired power burner designed for precise mixing of air and gas for optimum efficiency, requiring no special calibration on start-up.
7. Be approved for 0″ clearance to combustibles.
8. Come standard with leak detection module that provides audible and display notification if leak is detected.

D. The control shall be an integrated solid-state temperature and ignition control device with integral diagnostics, graphic user interface, fault history display, and shall have digital temperature readout.

1. All models are design certified by Underwriters Laboratories (UL), Inc., according to ANSI Z21.10.3 - CSA 4.3 standards governing storage type water heaters.
2. Meet the thermal efficiency and standby loss requirements of the U. S. Department of Energy and current edition ASHRAE/IES 90.1. Complies with SCAQMD Rule 1146.2 and other air quality management districts with similar requirements for low NOx emissions.

E. 60 Gallon Models: For Standard Power Venting and direct power venting: Water heater(s) shall be suitable for power venting using a 3” diameter PVC pipe for a maximum total distance of 100 ft equivalent feet of vent piping. For Power Direct Venting: Water heater(s) shall be suitable for power

F. Operation of the water heater(s) in a closed system where thermal expansion has not been compensated for (with a properly sized thermal expansion tank) will void the warranty.

G. Water heater shall incorporate the iCOMM™ system for remote monitoring, leak detection and fault alert or approved equal.

H. The heater tank shall be constructed of 316L stainless steel. The primary condensing heat exchanger shall be constructed of 90/10 cupronickel. The secondary heat exchanger shall be constructed of 800H stainless steel and 90/10 cupronickel.

I. Adaptive gas control:

1. Smart combustion system includes gas valve with servo motor and electronic controller.
2. Adjusts to fuel quality.

J. Control Screen:

1. Color touch display screen.
2. Temperature control.
3. Built-in Diagnostics and run history.
4. Wifi updates.
5. Remote connectivity.

K. Leak Detection:

1. Ships with leak detection module that allows installing contractor to install where needed.
2. Provides audible alarm and alert notification via iCOMM connectivity.

L. Powered Anodes:

1. Standard powered anodes for long-lasting tank protection.
2. Powered anodes are non-sacrificial.
3. Automatic adjustments.

M. Heat exchanger coil is glassed both externally and internally for optimum protection.

N. High Efficiency Modulating Pre-Mixed Powered Burner.

1. Top mounted burner.

O. Clearances:

1. 0” clearances on sides and 1.5” clearance on top.
2. Handhole cleanout for easy access to tank interior.
3. 0” clearance to combustibles.

P. Codes and Standards:

1. CSA certified and ASME rated T&P relief valve.
2. Maximum hydrostatic working pressure: 160 psi
3. All models are design certified by Underwriters Laboratories (UL), Inc., to ANSI Z21.10.3 - CSA 4.3 Standards
4. Meets the thermal efficiency and standby loss requirements of the U.S. Department of Energy and current edition ASHRAE/IES 90.1.
5. Design Certified by Underwriters Laboratories to NSF standard 5 for 180°F water.
6. Complies with SCAQMD Rule 1146.2 and other Air Quality Management Districts with similar requirements for low-NOx emissions.
7. ASME tank construction.

Q. The heater combustion system shall be provided with two pipe (intake and exhaust) closed combustion. Schedule 40 ASTM-D1785 PVC, Centrotherm InnoFlue PP vent system, and M&G Duravent PolyPro vent system are approved for venting applications. Horizontal Venting shall be done as a balanced system only, thus requiring both intake and exhaust to terminate on the same side of the building. The total combined length of exhaust and intake vents cannot exceed 200 combined feet for 3" venting.

R. The heater shall be in compliance with the NOx emissions limit set forth in SCAQMD Rule 1146.2. The heater shall be factory assembled, test-fired for correct BTU input, and adjusted for proper combustion parameters. Complete operating and installation instructions shall be furnished with every heater as packaged by the manufacturer for shipping.

S. The surfaces of these products contacted by consumable water contain less than 0.25% lead by weight, as required by the Safe Drinking Water Act, Section 1417.

T. Provide Options:

1. Combustion air vent kit including hoses, burner inlet adaptor, retaining clamps, and hardware.
2. Flue gas vent coupling.
3. Condensate Neutralization Kit complete with neutralizing granulate.
4. Low Water Cutoff w/Manual Reset & Test
5. The Firing Control System shall meet CSD-1 and FM requirements.
6. 3" PVC vent and intake termination with screen.

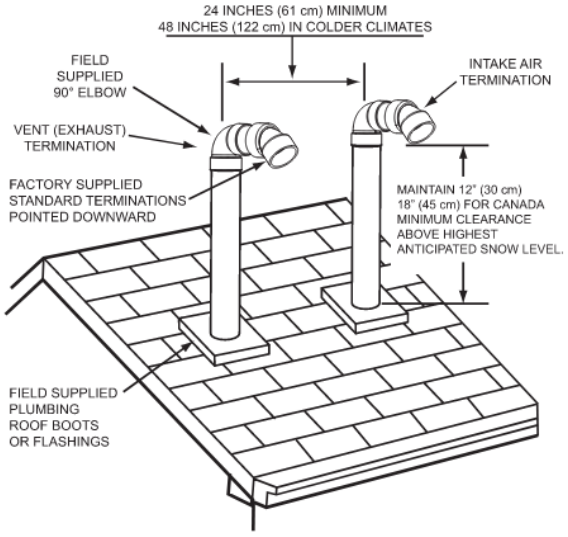


Figure 33. Vertical Termination - Direct Vent

7. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1, manually operated. Furnish for installation in piping.
8. Solenoid gas shutoff valve and shutoff switch/button.

PART 3 - EXECUTION

3.01 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base.

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

B. Install domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

C. Provide heaters according to the local codes, and manufacturer’s installation instructions.

D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend domestic-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

E. Assemble and install inlet and outlet piping for water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet.

F. Provide Heat traps: Storage tank-type water heaters and hot water storage tanks that have vertical water pipes connecting to the inlet and outlet of the tank shall be provided with integral heat traps at those inlets and outlets or shall have pipe-configured heat traps in the piping connected to those inlets and outlets.

G. Fill domestic-water heaters with water.

H. Charge domestic-water expansion tanks with air to required system pressure.

I. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water shall contain less than 0.25 percent of lead by weight.

3.02 GAS-FIRED WATER HEATER WIRING

A. Gas-fired equipment shall be wired in accordance with the fuel gas code requirements. Wire the equipment controls in accordance with manufacturer’s recommendations. Coordinate work with equipment spec sections.

B. Provide electrical devices furnished with equipment but not specified to be factory mounted.

C. Provide control wiring to field-mounted electrical devices.

D. Provide a flow switch if required by manufacturer.

E. Ground equipment according to Division 26.

F. Connect wiring according to Division 26.

G. The following requirements must be met with respect to the electrical wiring and equipment used in connection with propane or natural gas burning equipment:

1. The electrical wiring and equipment used must be provided in accordance with NFPA #70, *National Electrical Code* (2011 edition);
2. Safety control circuits must be two-wire, one side grounded, having a nominal voltage not exceeding 150 Volts. A safety control or protective device must be connected so as to interrupt the ungrounded conductor; and
3. The control circuit must be connected to a power supply branch circuit fused at not more than the value appropriate for the rating of any control or device included in the circuit.
4. Emergency Switch

    a. For central heating equipment and water heating appliances where the interruption of an electrical circuit will arrest the combustion process, an identified emergency shutdown switch must be placed outside of and adjacent to the entrance of the room where the appliance is located.
    b. An emergency switch shall not be placed outside of any building.
    c. If the entrance to the boiler room is only accessible from the outside, the emergency switch may be placed at the inside not more than one foot beyond the door opening.
    d. On multi-unit installations of commercial and industrial equipment, the emergency switch shall be installed in accordance with Figure 13-1.
    e. On multi-unit installations, the emergency shut-off switch must be placed at the outside entrance of the room containing the appliances. The emergency switches and the thermal cut-off switches must be wired in series through individual unit relays so that, if the emergency switch is opened, all heating equipment in the room and any electrically operated gas valves will be rendered inoperable. This application also applies if there are two or more appliance rooms in the same building that are connected to a common fuel supply system.

5. Service Switch: For central heating equipment and water heating appliances where the interruption of an electrical circuit will arrest the combustion process, a service disconnect switch for control of the burner while observing the flame must be placed at the unit, within 3´ of the burner.
6. Thermal Cut-Off Switches

    a. For central heating equipment and water heating appliances where the interruption of an electrical circuit will arrest the combustion process, a thermal cut-off switch must be wired into the burner circuit to shut off the burner in the event of a fire at the unit. The switch must be placed at the highest point directly above the unit to be fired with the thermal element pointed downwards and must be placed on the bottom of the floor joist or stringer at the front of the unit. In no case shall it be lower than the point where the flue connector enters the chimney. The switch must be wired to shut off the burner, circulating fan, forced or induced draft fan and any electrically operated gas valves. A thermal electric switch is required for each electrically powered gas-fired unit in a multi-appliance installation.
    b. On multi-unit installations the emergency and thermal electrical switches must be wired in series through individual unit relays so that, if one switch is opened, all equipment will be rendered inoperable whenever the "EMERGENCY" switch is opened.

3.03 CONDENSATE DRAINAGE

A. Condensate Pumps

1. Provide condensate pumps in accordance with manufacturer’s instructions.
2. Condensate pumps shall be interlocked with the appliance in such a manner as to shut down appliance in the event of condensate pump failure.

3. Each condensing appliance in a multi-appliance installation shall be provided with its own condensate pump.

B. Neutralization

1. An approved and properly sized neutralizer must be installed in the drain system. Condensate shall be drained into a plumbing code approved open receptor through an air gap fitting that is connected to the sanitary (sewer) system.
2. Provide neutralization system in accordance with manufacturer's instructions. Fill the relevant area provided with neutralizing granulate.

3.04 PIPING CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Section 22 11 16 "Domestic Water Piping."

B. Comply with requirements for gas piping specified in Section 23 11 23 "Facility Fuel-Gas Piping."

C. Drawings indicate general arrangement of piping, fittings, and specialties.

D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.05 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a factory-authorized service representative.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Domestic-water heaters will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.06 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain domestic-water heaters. Training shall be a minimum of one hour.

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. Kohler
3. Toto
4. 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; Church or Bemis; 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**: Wall mounted, back outlet, top spud. Sloan ST-2459-STG; Flushometer: Wall-mounted with a 1-1/2" top spud inlet. Antimicrobial glaze to inhibit bacteria, mold, and scale. Siphon jet flushing action, achieving a 1000g MaP score. Maximum static load of 1,000 lbs (when installed properly on a carrier).



1. Flushometer: Lever-Handle, Exposed, Piston Flushometer Valves: Sloan Crown 111-1.28.
   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 URINALS

A. Manufacturers

1. Sloan
2. American Standard, Inc.
3. Kohler Co.
4. Toto

B. **P-2**: Standard Wash-down Urinal, Sloan Model SU-1009-STG.



1. Comply with ASME A112.19.2 – Ceramic Plumbing Fixtures; Comply with ADA

2. Urinal shall be EPA Water Sense Certified.
3. Material: Vitreous china, white color.
4. Provide permanent glazed surface to inhibit the growth of stain and odor causing bacteria, mold, scale, and mildew on the surface.
5. Type: Siphon jet, wall hung.
6. Vandal-resistant strainer with integral trap.
7. Water Consumption: 1/8 GPF.
8. Support: Type I Urinal Carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include rectangular, steel uprights. Standard: ASME A112.6.1M.
9. Urinal Mounting Height: See Architectural Plans.
10. Manual Flushometer. Sloan Crown 186-0.5-CP Flush Valve, 0.5 GPF.
    a. 3/4" I.P.S. angle stop with back-flow prevention and vandal-resistant cap
    b. Sweat solder kit including cover tube and wall flange
    c. High back pressure vacuum breaker with down tube
    d. Spud coupling & flange for 3/4" top spud
    e. Self-cleaning brass piston with integral wiper spring prevents clogging and reduces maintenance
    f. Piston operation delivers superior flush accuracy and repeatability
    g. Piston valve remains closed and does not need to be reset after loss of water pressure
    h. Non-hold open handle
    i. Positive seal ensures leak-free performance
    j. No external volume adjustment
    k. Durable chrome-plated cast brass construction is ideal for commercial applications
    l. Chloramine-resistant EPDM seals
    m. Adjustable tailpiece for rough-in flexibility
    n. Can be installed left or right-handed
    o. ADA complaint

2.04 VITREOUS-CHINA LAVATORIES

A. Lavatory Manufacturers:

1. Sloan
2. Zurn
3. American Standard
4. Duravit

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. Size to conceal faucet power supply and mixing valve.
11. Faucets: See LAVATORY & SINK FAUCETS paragraph below.

C. **P-4**: Wall Mounted: Provide ASME A112.6.1M lavatory carrier. Lavatory mounting height: See architectural plans

1. Sloan “SloanTec” SS-3103-STG; Nominal Size: Rectangular, 20.75” x 18.25”. White, vitreous china wall hung lavatory with backsplash. Great complement to all of Sloan’s sensor faucet series. Front overflow provides clean appearance. Self-draining deck area with back and side splash shields. All mounting hardware included. IAPMO certified to meet or exceed ASME A112.19.2 standards. Meets ADA guidelines and ANSI A117.1 requirements when installed accordingly. Permanent SloanTec® hydrophobic antimicrobial glaze inhibits the growth and buildup of germs, bacteria, mold, mildew and mineral scale on the surfaces.



D. **P-3**: Under-Counter mounting; Provide sealant and under-counter mounting kit.

1. Sloan “SloanTec” SS-3021-STG; Nominal Size: Rectangular, 21.625” x 15.75”. White, vitreous china undermount lavatory. Rectangular shape provides alternate look to match a variety of restrooms. Great complement to all of Sloan’s sensor faucet series. All mounting hardware included • IAPMO certified to meet or exceed ASME A112.19.2 standards. Meets ADA guidelines and ANSI A117.1 requirements when installed accordingly. Permanent SloanTec® hydrophobic antimicrobial glaze inhibits the growth and buildup of germs, bacteria, mold, mildew and mineral scale on the surfaces.



E. Lavatory Faucets:

1. See faucet specifications in paragraphs hereinafter.
2. Sensor – battery
3. Sensor – self sustained.

2.05 STAINLESS STEEL SINKS – P-5

A. Sink Manufacturers:

1. Elkay Manufacturing Co.
2. Just Manufacturing Co.
3. Moen
4. Kindred
5. 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. DESIGNER SELECT BELOW
   a. Pipe covering kit equal to Dearborn Safety Series; Cover opens 180° for easy installation, EVA foam material, sized for 1 ¼” and 1 ½” cast traps, IAPMOPS-94.
   b. Piping shield equal Trubro Lav Shield.
8. Faucets: See LAVATORY & SINK FAUCETS paragraph below.

C. **P-5**: Top mounted self-rimming counter sink, 18 gauge; type 304 stainless steel. Basis of Design: Elkay LRADQ, 19.5” x 19” outside dimensions and 16” x 13.5” inside dimensions. ADA bowl depth: 6 1/2”.

1. Coordinate hole punches with faucet.
2. Drain Opening: Rear Center.
3. Drain: type 304 stainless perfect drain – Elkay LKPD1
4. 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.



2.06 LAVATORY & SINK FAUCETS

A. Faucet Manufacturers

1. Moen
2. Symmons
3. Delta Commercial
4. Chicago
5. Gerber
6. Zurn
7. Sloan
8. 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 ≤ 0.25% total lead content by weighted average
   4. Thermostatic mixing valves (TMV), as indicated: 20" flexible stainless steel inlet hoses with 3/8" compression fittings. ASSE 1070 certified down to 0.35 GPM
   5. Provide antimicrobial handles: Chicago Sureshield® Technology, or equal; In a 28-day dried film fungal test (ASTM G 21-96), the untreated sample shows significant fungal growth, while the Sureshield sample remains virtually unchanged.

C. Sensor Type:
   1. **P-3 & P-4**: Sink Faucet: Chicago Faucet Touchless Faucets 116.976.AB.1T, E-Tronic™ 40 electronic faucet with dual-beam infrared sensor. Traditional-style spout, chrome plated. Single-hole deck mount. 0.5 GPM (1.9 L/min) vandal-proof, pressure compensating, Econo-Flo™, non-aerating spray. Single supply for tempered water. Self Sustaining Power System (SSPS): water turbine generates the necessary power to operate the faucet for 10+ years External thermostatic mixing valve included. Multiple field-adjustable modes and ranges. Built-in Bluetooth® technology allows for easy adjustments and mode changes using a smartphone or tablet with the Chicago Faucets CF Connect App. ECAST™ construction with less than 0.25% lead content by weighted average. CALGreen compliant. 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, ASSE 1070, California Health and Safety Code 116875 (AB1953-2006), Vermont Bill S.152, NSF/ANSI 372 Low Lead Content, and California Green Building Standards Code (CALGreen).



   2. **P-5**: Sink Faucet: Chicago Faucets No. 116.985.AB.1T, HyTronic® electronic faucet with dual-beam infrared sensor, chrome plated - designed specifically for Patient Care Applications. Rigid/swing gooseneck spout, 5-1/4" center-to-center, with 1.5 GPM (5.7 L/min) laminar flow control insert in spout inlet. Single supply for tempered water. Powered by Long Term Power System (LTPS) - provides maintenance-free power for 15 years or more, depending on usage. Copper supply tube included. Multiple field-adjustable modes and ranges. Built-in Bluetooth® technology allows for easy adjustments and mode changes using a smartphone or tablet with the Chicago Faucets CF Connect App. ECAST® construction with less than 0.25% lead content by weighted

average. CALGreen compliant. 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, NSF/ANSI 372 Low Lead Content, and California Green Building Standards Code (CALGreen).



2.07 SHOWERS

A. Faucet Manufacturers

1. Symmons
2. Moen
3. Powers
4. Leonard
5. Grohe

B. **P-7**: Roll-In Shower (Tile walls and floor):

1. Shower Faucet: Symmons Origins S9608XPLR With Origins Shower/Hand Shower Trim, Temptrol® Pressure-Balancing Shower Valve,integral diverter control, metal lever handle, ADA 36" grab bar for hand shower wand, dual checks for backflow protection, 60" flexible metal hose, single-mode hand shower wand with NPSO, single-mode showerhead with easy to clean nozzles, and 1.5 gpm flow rate. Components shall be metal and nonmetal construction, plated in standard Polished Chrome finish. 10-Year Commercial Warranty. ASME A112.18.1/CSA B125.1, WaterSense 1.5gpm. Lever handle meets ADA requirements for opertion. BAA compliant for S9608PLR only. Provide options include: 15 = 1.5 gpm flow restrictor, CHKS = integral check stops, X = Integral service stops.



2. Provide floor drain. Josam 30000-5S-SS-T series type 316 cast stainless steel floor drain, two-piece body with double drainage flange, Wejloc® invertible flashing collar, weepholes, bottom threaded outlet connection and adjustable square Super-Flo® strainer.
   a. Provide the following options:
      1) -VP Secured grate, vandal-proof screws.
      2) -80 Perforated stainless-steel basket.
      3) -316 Type 316 strainer
      4) -50 Primer tap (where shown on drawings).

C. **P-6**: Standard Shower (Tile walls and floor):

1. Shower Faucet: Symmons Origins S-9601-PLR With Origins Shower, Temptrol® Pressure-Balancing Shower Valve. Adjustable stop screw to limit handle turn (included with S-9601-PLR), Integral volume control, Metal lever handle, 1 mode showerhead with easy to clean nozzles, Diverter tub spout not included, Components shall be metal and nonmetallic construction, plated in standard Polished Chrome finish, Available with TA-10 flow control spindle and T-12A cap assembly for Temptrol valve bodies installed with Test Cap (order p/n S9601PLRTRMTC). 10 Year Commercial Warranty. ASME A112.18.1/CSA B125.1, WaterSense 1.5 gpm. Provide the following options include: "1.5 - 1.5 gpm flow restrictor, X - Integral service stops - allows water shut-off at valve for service, CHKS - Integral check stops.



2. Provide floor drain. Josam 30000-5S-SS-T series type 316 cast stainless steel floor drain, two-piece body with double drainage flange, Wejloc® invertible flashing collar, weepholes, bottom threaded outlet connection and adjustable square Super-Flo® strainer.
   a. Provide the following options:
      1) -VP Secured grate, vandal-proof screws.
      2) -80 Perforated stainless-steel basket.
      3) -316 Type 316 strainer
      4) -50 Primer tap (where shown on drawings).

2.08 ELECTRIC WATER COOLERS

A. Manufacturers

1. Halsey Taylor.
2. Elkay Manufacturing Co.
3. Haws Corporation.
4. Oasis Corporation.
5. Sunroc Corp.

B. General

1. Adjust fixture flow regulators for proper flow and stream height. Adjust water-cooler temperature settings.
2. Waterways shall be 100% lead-free.
3. Laminar flow shall produce an even flow and eliminate splashing
4. Barrier free for full ADA access

C. **P-8:** Elkay LVRCTL8WSPRO Electric Water Cooler Vandal-Resistant Connected Bottle Filling Station&BiLevel ADA Cooler Refrig Ultra-Cap Lead Rd SS. Chilling Capacity of 8.0 GPH (gallons per hour) of 50° F drinking water, based on 80° F inlet water and 90° F ambient, per ASHRAE 18 testing. Features shall include Alcove Light, Automatic Filter Flush, Automatic Filter Status Reset, Energy Savings, Filtered, Green Ticker™, Hands Free, Laminar Flow, Pro Filtration System, Real Drain, Stainless Steel Alcove, Top Mount Quick Filter Change, Visual Filter Monitor, Cloud Connected Device, Vandal Resistant, Tempered Glass Display Cover. Furnished with Vandal Resistant bubbler. Electronic Bottle Filler Sensor with Mechanical Front Bubbler Button activation. Product shall be Wall Mount (On Wall), for Indoor applications, serving 2 station(s).



2.09 EMERGENCY PLUMBING FIXTURES

A. Manufacturers

1. Bradley Corporation
2. Encon Safety Products
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 – 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: ½" 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 & URINAL 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.

E. Provide cleanouts at urinals per Maine Plumbing Code.

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 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, inter-locks, 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 ¼” 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. 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 B22I, 32I, or 52I. 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 ¾ 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.

7. Provide hangers for copper piping with the following maximum horizontal spacing and minimum rod sizes:

    a. NPS ½ 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.

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 services 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 ¼" 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. Provide concrete housekeeping pads in accordance with Division 3.

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. Water heater and expansion tank.

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 his 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. 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).

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, locker rooms, bathrooms, and public areas.

C. 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.

D. Domestic cold water: Glass Fiber, ½” thickness.

E. Rainwater conductors: Glass Fiber, 1” thickness. All rainwater piping shall be insulated.

F. Roof Drain Bodies: Flexible Elastomeric, ½” thickness. Alternative: Roof drain bowls may be insulated with 2” of closed-cell spray-foam provided by Division 7. Coordinate with Division 7.

G. AC pan drain or other cold drain piping: Flexible Elastomeric, ½” thickness.

H. 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.

I. Water source heat pump loop water piping: No insulation required.

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. Return ducts within conditioned space: None required.

END OF SECTION

SECTION 23 09 00

DIRECT DIGITAL CONTROL (DDC) SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Provide a new Building Automation System (BAS) to integrate and control equipment associated with this project. Provide all labor, materials, equipment, and service necessary for a complete and operating BAS.

B. <u>Tie-Into Existing Siemens BAS</u>

1. Provide a SEAMLESS tie-in to the existing Siemens BAS. The tie-in shall include Direct Digital Control (DDC), historical data collection, archiving and alarm, energy and information management for all control points specified herein.
2. Tie-in to existing site BAS of all DDC equipment and points as specified in this section and as required in all other referenced sections and as required to complete the sequences of operation outlined herein. Tie-in shall be made via an extension of the existing BAS.
3. Provide new color graphics for all new systems specified in this contract.
4. Revisions to all existing BAS workstations as required to incorporate the additional control components provided under this section. Revisions shall include, but are not limited to, revised graphics, update of additional firmware and/or software as required.
5. Add graphics for all equipment currently on the existing system/network that is missing graphics.

C. System software shall be based on a server/thin client architecture, designed around the open standards of web technology. The control system server shall be accessed using a Web browser over the control system network, the owner's local area network, and (at the owner's discretion) over the Internet. The intent of the thin-client architecture is to provide operators complete access to the control system via a Web browser. No special software other than a web browser shall be required to access graphics, point displays, and trends, configure trends, configure points and controllers, or to download programming into the controllers.

D. System shall use the BACnet protocol for communication to the operator workstation or web server and for communication between control modules. I/O points, schedules, setpoints, trends and alarms shall be BACnet objects.

E. The Controls Contractor’s work shall consist of the provision of all labor, materials, special tools, equipment, enclosures, power supplies, software, software licenses, project-specific software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, submittals, testing, verification, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, 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.

F. Provide all labor, materials, equipment, and service necessary for a complete and operating building automation system.

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”
4. Division 23 Sections with controller interfaces shall be integrated with the work of this Section.
5. Division 23 Section “Testing, Adjusting, and Balancing”
6. Division 26
7. Division 28 Section "Fire Alarm”

1.02 SUBMITTALS

A. Product Data and Shop Drawings: Meet requirements of Division 1. In addition, the contractor shall provide shop drawings or other submittals on hardware, software, and equipment to be installed or provided. No work may begin on any segment of this project until submittals have been approved for conformity with design intent. Provide drawings in PDF format. When manufacturer’s cutsheets 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. Each submitted piece of literature and drawing shall clearly reference the specification and/or drawing that the submittal is to cover. General catalogs shall not be accepted as cutsheets to fulfill submittal requirements. Select and show submittal quantities appropriate to scope of work. Submittal approval does not relieve Contractor of responsibility to supply enough to complete work. BAS manufacturer is responsible for furnishing quantities required based upon contract documents.

B. 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.

C. 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.

D. 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.

E. 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.

F. 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.

G. Submit the following:

1. A complete bill of materials of equipment to be used indicating quantities, manufacturers, and model numbers.
2. 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.

3. A schedule of all control dampers including damper size, pressure drop, manufacturer, and model number.
4. 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:

    a. Building Controllers
    b. Custom Application Controllers
    c. Application Specific Controllers
    d. Operator Workstations
    e. Portable Operator Terminals
    f. Auxiliary Control Devices

5. Provide proposed BAS 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 for this project.

H. Project Record Documents: Upon completion of installation, record (as-built) documents. The documents shall be submitted for approval prior to final completion and include:

I. 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.

1. Testing and Commissioning Reports and Checklists signed off by trained factory (equipment manufacturers) and field (BAS) commissioning personnel.
2. 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.

J. 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.

1.03 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. All work described in this section shall be installed, wired, circuit tested and calibrated by factory certified technicians qualified for this work and in the regular employment of the temperature control system manufacturer. Use only employees who are qualified, skilled, experienced, manufacturer trained and familiar with the specific equipment, software and configurations to be provided for this Project.

1. Installer shall have an established working relationship with Control System Manufacturer.
2. Installer shall have successfully completed Control System Manufacturer's control system training. Upon request, Installer shall present record of completed training including course outlines.

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.

1.04 CONTRACTOR QUALIFICATIONS

A. Qualified Bidders: System shall be as manufactured, installed, and serviced by:

1. Siemens Design (Basis of Design) –
   a. Factory Branch Office – 66 Mussey Road, Scarborough, ME 04074
   b. Contact: Brandon Corbo
   c. Email: brandon.corbo@siemens.com
   d. Phone: 207-303-9362
2. Johnson Controls, Inc.
3. Honeywell
4. Trane
5. Approved bidders. Bids from other vendors, franchised dealers, manufacturer's representatives, or from contractors who are authorized to represent the above-named manufacturers must be pre-approved.

B. The BAS contractor shall be an independent contractor not affiliated with the mechanical contractor. Only the Scarborough Maine branch office of the controls system manufacturer shall be acceptable. Associated control dealers and VAPS (despite the product line) shall not be eligible to bid on this project.

C. 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.

D. 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.

E. Longevity: The Facilities Management System contractor shall have a minimum of ten years’ experience installing and servicing computerized Building Automation Systems (BAS). All subcontractors utilized by the BAS contractor shall have a minimum of five-year experience within their appropriate trades.

F. Past Projects: The BAS contractor shall have completed a minimum of ten projects within the last five years that are at least equal in dollar value and scope to this project. A list of similar projects, dollar volume, scope, contact name and contact number shall be provided by the BAS contractor if asked for by the owner.

G. The BAS manufacturer shall have an established business office within 50 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.

H. The BAS contractor shall have an established 24-hour emergency service organization. A dedicated telephone number shall be provided to the owner for requesting emergency service. A maximum of four-hour, electronic service technician on sight, response time shall be guaranteed by the BAS contractor.

I. Parts Stocking: The BAS contractor shall have an independently verifiable inventory of electronic service parts. This electronic service parts inventory must have a worth of at least $100,000 per year over the last five years.

1.05 COORDINATION

A. Where the mechanical work will be installed near, 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, 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 details of telephone line, internet service provider, and associated requirements.

C. 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.

D. Coordinate location of thermostats and other exposed control sensors with plans and room details before installation.

E. 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.

F. 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.

G. Sheet Metal Subcontractor:

1. Installation of duct-mounted control devices.
2. Access doors where indicated and as required for proper servicing.

H. HVAC Contractor:

1. Installation of immersion wells and sockets, along with associated shut-off cocks.
2. Installation of pipe-mounted control devices.

I. Testing and Balancing Contractor:

1. The contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.
2. The contractor shall provide training in the use of these tools.
3. In addition, the contractor shall provide a qualified technician to assist in the test and balance process, until the first 20 terminal units are balanced.

4. The tools used during the test and balance process shall be returned at the completion of the testing and balancing.

J. 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 control wiring shown on electric plans such as unit heater line-voltage room thermostats.
3. Duct smoke detectors required for air handler shutdown are supplied under Division 26. Coordinate required length of sampling tube, for full span of ductwork. The contractor shall connect the DDC system to the auxiliary contacts provided on the smoke detector for system safeties and to provide alarms to the DDC system.
4. All electrical work shall comply with the N.E.C. and local electrical codes.
5. All safety devices shall be wired through both hand and auto positions of motor starting device to insure 100% safety shut-off.
6. Provide auxiliary contacts as required for interlock by BAS Contractor; the supplier shall estimate an allowance of at least one auxiliary contract per starter.

K. 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 by the BAS contractor 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. The BAS contractor shall 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.
4. The BAS contractor is responsible for providing all controls described in the contract documents regardless of where within the contract documents these controls are described.
5. The contractor is responsible for the interface of control products provided by multiple suppliers regardless of where this interface is described within the contract documents.

1.06 DELIVERY, STORAGE, AND HANDLING

A. System Software: Update to latest version of software at Project completion.

1.07 WARRANTY

A. Refer to Division 1 Requirements.

B. At the end of the final start-up, testing, and commissioning phase, if equipment and systems are operating satisfactorily to the engineer, the engineer shall sign certificates certifying that the control system’s operation has been tested and accepted in accordance with the terms of this specification. The date of acceptance shall be the start of warranty. All work shall have a single warranty date, even when the owner has received beneficial use due to an early system start-up.

C. All components, system software, and parts supplied by the BAS contractor shall be guaranteed against defects in materials and workmanship for one year from acceptance date. The BAS

contractor at no charge shall furnish Labor to repair, reprogram, or replace components during the warranty period. All corrective software modifications made during warranty periods shall be updated on all user documentation and on user and manufacturer archived software disks. The Contractor shall respond to the owner's request for warranty service within 24 hours during normal business hours.

D. Provide remote service diagnostic monitoring from the nearest service location. At the request of the owner, a service diagnostic call will be made to troubleshoot and resolve (if possible) any reported system complaints. The owner will provide a dedicated telephone line for connection to the system.

E. Operator workstation software, project-specific software, graphic software, database software, and firmware updates that resolve known software deficiencies as identified by the contractor shall be provided at no charge during the warranty period. Any upgrades or functional enhancements associated with the above-mentioned items also can be provided during the warranty period for an additional charge to the owner by purchasing an in-warranty service agreement from the contractor. Written authorization by the owner must, however, be granted prior to the installation of any of the above-mentioned items.

1.08 SYSTEM MAINTENANCE AND REMOTE ANALYSIS

A. The BAS Manufacturer shall provide BAS remote support and system analysis for a period of two (2) years, beginning at 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 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 owner's network to gain access to the internet. The BAS manufacturer 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 manufacturer to coordinate with the owner for network connectivity.

D. The BAS Manufacturer shall provide a professional analysis for the facility HVAC systems. 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 Manufacturer 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.

1.09 OWNERSHIP OF PROPRIETARY MATERIAL

A. Project specific software and documentation shall become the owner's property upon project completion. This includes the following:

1. Operator Graphic files
2. As-built hardware design drawings
3. Operating & Maintenance Manuals
4. BAS System software database

PART 2 - PRODUCTS

2.01 BUILDING AUTOMATION SYSTEM

A. The BAS shall consist of a network of standalone microprocessor-based direct digital control units (DDCs). Each direct digital control unit shall perform all specified control and monitoring functions independently. Failure of one (1) control unit shall have no effect upon any other unit in the network. The direct digital control units shall communicate with each other and the servers and workstations. The BAS shall include a full graphic software and graphical operator interface.

B. System input/output point capacity shall be expandable by the addition of DDC units and unitary controllers to the communications network.

C. The operator, through any workstation, shall have the ability to monitor DDC application and sensor data, override set points and schedules, set and reset control points and download programs to the local direct digital control units. A server and workstation network requiring database changes to be made at more than one (1) location shall not be acceptable.

D. Communication protocol between server, workstations, DDC and unitary controllers shall utilize ASHRAE Standard 135 BACnet. In addition, the DDC system shall be capable of providing industry-standard open-protocol communication (BACnet, Modbus, OPC, SOAP, SNMP, XML) to other equipment and/or building systems.

E. The direct digital control units shall be UL 916 (Energy Management Equipment) listed.

F. Communication between the workstations and server shall be by way of a high-speed communications cable utilizing Ethernet technology. The DDC units shall also communicate directly to the server utilizing Ethernet technology.

G. DDC units serving air handling units and water systems shall communicate via BACnet/SC or BACnet/IP. Provide one (1) DDC unit per system unless otherwise specified.

H. Unitary controllers serving VAVs, etc. shall communicate via BACnet/SC or BACnet/IP. Unitary controllers utilizing BACnet MS/TP communication shall NOT be acceptable. Provide one (1) unitary controller per terminal unit unless otherwise specified.

I. The furnished BAS shall be complete in all respects so that it shall perform its specified functions in accordance with this section of the specifications. Implementation of all control functions shall be the responsibility of the BAS provider.

J. The entire BAS shall be complete with all necessary control devices, thermostats, valves, motors, relays, switches, dampers, panel, and electric wiring to provide the functions as described hereinafter, regardless of whether or not they are specifically mentioned.

K. The BAS shall be installed complete in all respects by competent personnel, factory-trained by the manufacturer of the control system. All automatic control valves and dampers shall be installed in pipelines and ducts by the respective trade under supervision of the control system provider

L. All point names, equipment names, equipment labeling, etc., must comply with Owner's equipment naming convention. The vendor is responsible for coordinating with the Owner to determine standards and providing their implementation.

M. All workstation graphics must comply with Owner's standard. The vendor is responsible for coordinating with the Owner to determine standards and providing their implementation.

N. Workstation advisory messages, printouts, logging, alarm formats, etc., must follow Owner's standards.

O. All software provided for this project shall include manufacturer's certificate and shall be original software purchased for this project. All third-party software shall also be the original software.

P. Provide new wiring and network devices as required to provide a complete and workable control network.

2.02 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional to design DDC system to satisfy requirements indicated. System Performance Objectives:

1. DDC system shall manage HVAC systems.
2. DDC system control shall operate HVAC systems to achieve optimum operating costs while using least possible energy and maintaining specified performance.
3. DDC system shall respond to power failures, HVAC equipment failures, and adverse and emergency conditions encountered through connected I/O points.
4. DDC system shall operate while unattended by an operator and through operator interaction.
5. DDC system shall record trends and transaction of events and produce report information such as performance, energy, occupancies, and equipment operation.

B. DDC System Data Storage:

1. Include server(s) with disk drive data storage to archive not less than 36 consecutive months of historical data for all I/O points connected to system, including alarms, event histories, transaction logs, trends and other information indicated.
2. When logged onto a server, operator shall be able to also interact with any DDC controller connected to DDC system as required for functional operation of DDC system.
3. Server(s) shall be used for application configuration; for archiving, reporting and trending of data; for operator transaction archiving and reporting; for network information management; for alarm annunciation; and for operator interface tasks and controls application management.
4. Server(s) shall use IT industry-standard database platforms such as Microsoft SQL Server and Microsoft Data Engine (MSDE).

C. Performance Standards. System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer's recommended hardware and software for operator workstation (server and browser for web-based systems).

1. Graphic Display. A graphic with 20 dynamic points shall display with current data within 10 sec.
2. Graphic Refresh. A graphic with 20 dynamic points shall update with current data within 8 sec. and shall automatically refresh every 15 sec.
3. Configuration and Tuning Screens. Screens used for configuring, calibrating, or tuning points, PID loops, and similar control logic shall automatically refresh within 6 sec.
4. Object Command. Devices shall react to command of a binary object within 2 sec. Devices shall begin reacting to command of an analog object within 2 sec.
5. Alarm Response Time. An object that goes into alarm shall be annunciated at the workstation within 45 sec.
6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 sec. Select execution times consistent with the mechanical process under control.
7. Performance. Programmable controllers shall be able to completely execute DDC PID control loops at a frequency adjustable down to once per sec. Select execution times consistent with the mechanical process under control.
8. Multiple Alarm Annunciation. Each workstation on the network shall receive alarms within 5 sec of other workstations.
9. Reporting Accuracy. System shall report values with minimum end-to-end accuracy listed in Table 1.
10. Control Stability and Accuracy. Control loops shall maintain measured variable at setpoint within tolerances listed below.
11. Measured Variable and Reported Accuracy

    a. Space Temperature; ±0.5ºC (±1ºF)
    b. Ducted Air: ±0.5ºC (±1ºF)
    c. Outside Air: ±1.0ºC (±2ºF)
    d. Dew Point: ±1.5ºC (±3ºF)
    e. Water Temperature: ±0.5ºC (±1ºF)
    f. Delta-T: ±0.15º (±0.25ºF)
    g. Relative Humidity: ±5% RH
    h. Water Flow: ±2% of full scale
    i. Airflow (terminal): ±10% of full scale; Accuracy applies to 10%–100% of scale.
    j. Airflow (measuring stations): ±5% of full scale.
    k. Airflow (pressurized spaces): ±3% of full scale
    l. Air Pressure (ducts): ±25 Pa (±0.1 in. w.g.)
    m. Air Pressure (space): ±3 Pa (±0.01 in. w.g.)
    n. Water Pressure: ±2% of full scale
    o. Electrical: ±1% of reading, Not including utility-supplied meters
    p. Carbon Monoxide (CO): ±5% of reading

q. Carbon Dioxide (CO2): ±50 ppm

12. Control Stability and Accuracy

a. Air Pressure: ±50 Pa (±0.2 in. w.g.); Range of Medium: 0–1.5 kPa (0–6 in. w.g.)
b. Air Pressure: ±3 Pa (±0.01 in. w.g.); Range of Medium: 25 to 25 Pa (-0.1 to 0.1 in. w.g.)
c. Airflow: ±10% of full scale
d. Space Temperature: ±1.0ºC (±2.0ºF)
e. Duct Temperature: ±1.5ºC (±3ºF)
f. Humidity: ±5% RH
g. Fluid Pressure: ±10 kPa (±1.5 psi); Range of Medium: 1–150 psi

D. Environmental Conditions for Controllers, Gateways, Routers, Instruments and Actuators: 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.

E. 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.

2.03 COMMUNICATION

A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135, BACnet.

B. Provide new wiring and network devices as required to provide a complete and workable control network.

C. Each controller shall have a communication port for temporary connection to a laptop computer or other operator interface. Connection shall support memory downloads and other commissioning and troubleshooting operations.

D. Internetwork operator interface and value passing shall be transparent to internetwork architecture.

E. An operator interface connected to a controller shall allow the operator to interface with each internetwork controller as if directly connected. Controller information such as data, status, and control algorithms shall be viewable and editable from each internetwork controller.

F. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute control strategies specified in Section 23 09 93. An authorized operator shall be able to edit cross-controller links by typing a standard object address or by using a point-and-click interface.

G. Workstations, Building Control Panels, and Controllers with real-time clocks shall use the BACnet Time Synchronization service. System shall automatically synchronize system clocks daily from an operator-designated device via the internetwork. The system shall automatically adjust for daylight saving and standard time as applicable.

H. System shall be expandable to at least twice the required input and output objects with additional controllers, associated devices, and wiring.

2.04 DDC EQUIPMENT

A. OPERATOR WORKSTATION HARDWARE

1. Provide one (1) new operator workstation. Operator workstation shall be located with the engineers office.
2. Workstation shall be provided for command entry, information management, network alarm management and database management functions. All real time control functions shall be resident in the DDC Controllers to facilitate greater fault tolerance and reliability.
3. Each workstation shall consist of the following, at a minimum:
4. Minimum sixteen (16) GB RAM
5. One (1) 500 GB SSD
6. Processor shall have a minimum speed of 3.0 GHz with no less than 4 cores
7. Mouse and 101-key enhanced keyboard.
8. Provide a monitor of flat panel type and shall support a minimum display resolution of no less than 1920 x 1080 pixels. The display shall have a minimum of 27-inch visible area in diagonal measurement. Separate controls shall be provided for color, contrasts and brightness. The screen shall be non-reflective.
9. Locate the Operator Workstations in a clean, secure, dry and temperature-controlled environment
10. Provide thirty (30) minute rated UPS.
11. Provide software licenses for interfacing to the BAS. Load software, configure and setup for viewing the BAS system.
12. Provide the PC with an operating system, such as Windows 10 Pro or Windows Server 2016/2019 or other operating systems compatible with the BAS software.
13. Software: Provide the following application software licenses, preloaded on the workstation for the Owner: MS Office Professional, Internet Explorer or equal browser, MS Outlook, Acrobat Reader, CAD Viewer, Antivirus. Set up an icon on the desktop to take the Owner directly to the BAS system login page.
14. Keyboard: QWERTY, 105 keys in ergonomic shape.
15. 16x DVD-RW drive
16. Mouse: Three button, optical
17. Provide additional hardware (communication ports, video drivers, network interface cards, cabling, etc.) to facilitate all control functions and software requirements specified for the DDC system.

B. Operator Interface. Web server shall reside on high-speed network with building controllers. Each standard browser connected to server shall be able to access all system information.

C. Communication. Web server or workstation and controllers shall communicate using BACnet protocol. Web server or workstation and control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ANSI/ASHRAE 135, BACnet Annex J.

D. Operator Workstation:

1. Workstation or web server. Industry-standard hardware shall meet or exceed DDC system manufacturer's recommended specifications and shall meet response times specified elsewhere in this document. The following hardware requirements also apply:

    a. The hard disk shall have sufficient memory to store:

        1) All required operator workstation software.
        2) A DDC database at least twice the size of the delivered system database.
        3) One year of trend data based on the points specified to be trended at their specified trend intervals.

    Provide additional hardware (communication ports, video drivers, network interface cards, cabling, etc.) to facilitate all control functions and software requirements specified for the DDC system.

2. Minimum hardware configuration shall include the following:

    a. Motherboard: With 8 integrated USB 2.0 ports, integrated PCIE 10/100/1000 network adapter
    b. Processor: Intel® Core™ i7
    c. Hard drive shall be solid state type. The hard disk shall have sufficient memory to store: All required operator workstation software. A DDC database at least twice the size of the delivered system database. Three years of trend data based on the points specified to be trended at their specified trend intervals. Minimum size: 500GB.
    d. Random-Access Memory: 16 GB minimum.
    e. 90% Efficient Power Supply, Energy Star 5.0 compliant
    f. Graphics: card as recommended by BAS supplier for optimum performance.
    g. Monitor: 23.8-inch (minimum) High-Definition LED Display (1920 x 1080 at 75 Hz) with anti-glare.
    h. Keyboard: QWERTY, 105 keys in ergonomic shape.
    i. 16x DVD-RW drive
    j. Mouse: Three button, optical.
    k. APC BR1000G Back-UPS Pro 1000 VA 120V Power-Saving UPS System
    l. Operating System: Latest Windows with high-speed Internet access.
    m. Provide additional hardware (communication ports, video drivers, network interface cards, cabling, etc.) to facilitate all control functions and software requirements specified for the DDC system.
    n. Serial, parallel, and network communication ports and cables as required for proper DDC system operation.

2.05 BUILDING MANAGEMENT SYSTEM SOFTWARE

A. General
    1. Provide software which includes the following:
        a. Scheduling and override of building operations.
        b. Collection and analysis of historical data.
        c. Editing, programming, storage and downloading of controller databases, programs and parameters.
        d. The latest version Microsoft Windows environment that allows the user to run several applications simultaneously. Other Windows applications shall run simultaneously with the BAS software including, but not limited to, Word, Excel, Access, etc.

e. Provide a user interface that shall minimize the use of a typewriter style keyboard through the use of a mouse or similar pointing device and "point and click" approach to menu selection.
f. The operator shall be able to drag and drop information between applications (e.g., click on a point in the alarm screen and drag it into the dynamic trend graph screen to initiate a dynamic trend).
g. Operator specific password access protection shall allow the user to limit workstation control, display and data base manipulation capabilities for each object in the system. An object shall be defined as any input or output point, setpoint, system program, etc. The operator privileges shall “follow” the operator to any workstation or primary control panel that the operator logs on to. Provide a minimum of 1000 passwords.
h. Operators will be able to perform only those commands on the objects available based on their respective passwords. Menu selections displayed shall be limited to only those items defined for the access level of the password used to log-on.
i. An audit trail report to track system object changes that shall record operator initiated actions. These actions shall include, but not be limited to, changes made by a particular person, changes made to a specific piece of equipment and/or changes made during a designated time frame. The changes shall be printed and archived for future reference either on command or automatically, at the operator’s option. The operator activity tracking data shall be stored in a tamper proof buffer.
j. Software shall allow the operator to perform commands including, but not limited to:
    1) Start up and shutdown of equipment.
    2) Setpoint adjustment.
    3) Add/modify/delete time programming.
    4) Enable/disable process execution.
    5) Lock/unlock alarm reporting.
    6) Enable/disable totalization and/or trending.
    7) Override PID loop setpoints.
    8) Enter temporary override schedules.
    9) Define holiday schedules.
    10) Change time/date.
    11) Automatic daylight savings time adjustments.
    12) Enter/modify analog warning and alarm limits.

2. Reporting
    a. Reports shall be generated and directed to displays, printers or disk. As a minimum, the system shall allow the user to easily obtain the following types of reports:
        1) A general listing of all points in the network.
        2) List of all points currently in alarm.
        3) List of all points currently in override status.
        4) List of all disabled points.
        5) List of all points currently locked out.
        6) DDC Controller trend overflow warning.
        7) List all weekly schedules.
3. Scheduling
    a. Provide a graphical spreadsheet-type format for simplification of time-of-day scheduling and overrides of building operations. Provide schedules for 365 days in advance.
    b. Weekly schedules shall be provided for each building zone or piece of equipment with a specific occupancy schedule. Temporary overrides and associated times may be inserted into blocks for modified operating schedules. After overrides have been executed, the original schedule will automatically be restored.
    c. Zone schedules shall be provided for each building zone as previously described. Each schedule shall include all points that can be commanded residing within the zone. Each point may have a unique schedule of operation relative to the zone's occupancy schedule, allowing for sequential starting and control of equipment within

the zone. Scheduling and rescheduling of points may be accomplished easily via the zone schedule graphic.

4. Password
   a. Multiple-level password access protection shall be provided to allow the user/manager to limit workstation control, display, and database manipulation capabilities as he or she deems appropriate for each user, based on an assigned password.
   b. Each user shall have the following: a user name (12 characters minimum); a password (12 characters minimum), and an access level (from 1 - 5).The system shall allow each user to change his or her password at will.
   c. When entering or editing passwords, the system shall not echo the actual characters for display on the monitor.
   d. A minimum of five levels of access shall be supported as follows.
      1) Level 1 = Data Access and Display
      2) Level 2 = Level 1 and Operator Overrides
      3) Level 3 = Level 2 and Database Modification
      4) Level 4 = Level 3 and Database Generation
      5) Level 5 = All privileges, including Password Add/Modify
   e. A minimum of 100 unique passwords, including user initials, shall be supported.
   f. Operators shall be able to perform only those commands available for their respective passwords. Display of menu selections shall be limited to only those items defined for the access level of the password used to log-on.
   g. The system shall automatically generate a report of log-on/log-off and system activity for each user. Any action that results in a change in the operation or configuration of the control system shall be recorded, including: modification of point values, schedules or history collection parameters, and all changes to the alarm management system, including the acknowledgment and deletion of alarms.
   h. User-definable, automatic log-off timers of from 1 to 60 minutes shall be provided to prevent operators from inadvertently leaving the operator workstation logged on.
5. Collection and Analysis of Historical Data
   a. Provide trending capabilities that allow the user to easily monitor and preserve records of system activity over an extended period of time. Any system point may be trended automatically at time-based intervals or changes of value, both of which shall be user-definable. Trend data shall be stored on hard disk for future diagnostics and reporting.
   b. Trend data report graphics shall be provided to allow the user to view all trended point data. Reports may be customized to include individual points or pre-defined groups of at least 6 points. Provide additional functionality to allow any trended data to be transferred directly to an off-the-shelf spreadsheet package such as Excel. This shall allow the user to perform custom calculations such as energy usage, equipment efficiency and energy costs and shall allow for generation of these reports on high-quality plots, graphs and charts.
   c. Provide additional functionality that allows the user to view trended data on trend graph displays. Displays shall be actual plots of both historical and/or real-time dynamic point data. A minimum of 10 points shall be viewed simultaneously on a single graph. The user may pause the graph and take "snapshots" of screens to be stored on the hard disk for future recall and analysis. Displays shall include an 'X' axis indicating elapsed time and a 'Y' axis indicating a range scale in engineering units for each point. The 'Y' axis shall have the ability to be manually or automatically scaled at the user's option. Different ranges for each point may be used with minimum and maximum values listed at the bottom and top of the 'Y' axis. All 'Y' axis data shall be color-coded to match the line color for the corresponding point.
   d. Static graphs shall represent actual point data that has been trended and stored on disk. Exact point values may be viewed on a data window by pointing or scrolling to the place of interest along the graph. Provide capability to print any graph on the system printer for use as a building management and diagnostics tool.

e. Dynamic graphs shall represent real-time point data. Any point or group of points may be graphed, regardless of whether they have been predefined for trending. The graphs shall continuously update point values. At any time the user may redefine sampling times or range scales for any point. In addition, the user may pause the graph and take "snapshots" of screens to be stored on the workstation disk for future recall and analysis. As with static graphs, exact point values may be viewed and the graphs may be printed.

6. Dynamic Color Graphic Displays
   a. All workstation(s) shall be provided with color graphics. All workstation(s) software shall include a graphical viewing and control environment and definition and construction of dynamic color graphic displays.
   b. Provide system color graphics for each HVAC system and for each electrical, plumbing and/or piping system that is monitored and/or controlled by the BAS. Provide scaled floor plans indicating equipment location, service and system data as required.
   c. Provide color graphic floor plan displays and system schematics for each piece of mechanical equipment, including but not limited to air handling units, chilled water systems and hot water systems to optimize system performance analysis and speed alarm recognition.
   d. Provide links on each graphic to PDF files of the associated sequence of operation, flow diagram, and wiring diagram.
   e. The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection or text-based commands.
   f. Dynamic temperature values, humidity values, flow values and status indication shall be shown in their actual respective locations and shall automatically update to represent current conditions without operator intervention.
   g. The windowing environment of the PC operator workstation(s) shall allow the user to simultaneously view several graphics at a time to analyze total building operation or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.
   h. Graphic generation software shall be provided to allow the user to add, modify, or delete system graphic displays via an off the shelf graphics package.
   i. Provide libraries of pre-engineered screens and symbols depicting standard air handling unit components (e.g., fans, cooling coils, filters, dampers, etc.), complete mechanical systems (e.g., constant volume-terminal reheat, VAV, etc.) and electrical symbols.
   j. Graphical displays can be created to represent any logical grouping of system points or calculated data based upon building function, mechanical system, building layout, or any other logical grouping of points that aids the operator in the analysis of the facility.
   k. Graphical displays shall contain animation to assist the operator in determining status of the equipment being displayed (e.g., a fan that is energized shall rotate).
   l. Provide an automatically updated, dynamic display of the site-specific BAS architecture indicating the status of primary and secondary controllers, PC workstation(s) and networks.
   m. Provide a separate dynamic display page of each HVAC (AHU, AC, chiller, cooling tower, fuel oil, etc.), electrical and/or plumbing system connected to the BAS.
   n. Provide a separate dynamic display page of each piece of terminal equipment (VAV box, fan coil unit, etc.) connected to the BAS.
   o. Provide a separate dynamic display page for each floor or zone. At a minimum, each page shall display the associated space temperature readings and links to equipment located on the floor or in the zone.
   p. Provide an additional (10) separate dynamic, graphic display pages at each workstation as required by the operating staff to further assist in daily system operations.

q. Graphics shall incorporate all system integration points communicated via hardware or software gateways and/or interfaces. Origin of information shall be transparent to the operator and shall be controlled, displayed, trended, etc. as if the points were hardwired to the BAS.

7. System Configuration and Definition
   a. All temperature and equipment control strategies and energy management routines shall be definable by the operator. System definition and modification procedures shall not interfere with normal system operation and control.
   b. The system shall be provided complete with all equipment and documentation necessary to allow an operator to independently add, delete or modify any system object including primary control panel(s), operator workstations(s), secondary control panels, reporting definitions, control loops, energy management applications, time and calendar-based programming, totalization, historical data trending, custom control processes, graphic displays, operator passwords, alarm messages, etc.
   c. Definition of operator device characteristics for individual points, applications and control sequences shall be performed using instructive prompting software.
   d. Programming shall be performed with the BAS system online and shall not interfere with BAS system operation.
   e. Inputs and outputs for any process shall not be restricted to a single primary control panel, but shall be able to include data from any and all other network panels to allow the development of network-wide control strategies. Processes shall also allow the operator to use the results of 1 process as the input to any number of other processes (cascading).
   f. Provide the capability to backup and store all system databases on the workstation hard disk. In addition, all database changes shall be performed while the workstation(s) are on-line without disrupting other system operations. Changes shall be automatically recorded and downloaded to the appropriate primary control panel. Similarly, changes made at the primary control panels shall be automatically uploaded to the workstation, ensuring system continuity. The user shall also have the option to selectively download changes as desired.
   g. Provide context-sensitive help menus to provide instructions appropriate with operations and applications currently being performed.
8. Event Management
   a. Event Notification shall be presented to each workstation in a tabular format application, and shall include the following information for each event: name, value, event time and date, event status, priority, acknowledgement information, and alarm count.
   b. Only events for which the logged on user has privileges to view shall be displayed on each workstation.
   c. The software shall provide the ability to users to limit the list of events displayed at each workstation (e.g. only show fire events at this workstation, no matter who is logged on)
   d. Each event shall have the ability to sound an audible notification based on the category of the event.
   e. Event List shall have the ability to list and sort the events based on event status, point name, ascending or descending activation time.
   f. Directly from the Event List, the user shall have the ability to acknowledge, silence the event sound, print, or erase each event.
   g. The interface shall provide the option to inhibit the erasing of active acknowledged events, until they have returned to normal status.
   h. The user shall have the ability to navigate to all information related to a selected point in order to command, launch an associated graphic or trended graphical plot, or run a report on a selected point directly from the Event List.
   i. Each event shall have a direct link from the Event List to further user-defined point informational data.

j. The user shall have the ability to also associate real-time electronic annotations or notes to each event.
k. Software shall provide the option to configure detailed operating procedures that guide a user through predetermined standard operating procedures for handling critical events. Users shall be able to log completion of each operating step as it is performed.

9. Remote Notification (RENO)
   a. Workstations shall be configured to send out messages to numeric pagers, alphanumeric pagers, SMS (Simple Messaging Service, text messaging) Devices, and email accounts based on a point's alarm condition.
   b. Email notification must support POP3, IMAP, and SMTP with SSL/TSL
   c. Communication with external software must be encrypted.
   d. There shall be no limit to the number of points that can be configured for remote notification of alarm conditions and no limit on the number of remote devices which can receive messages from the system.
   e. On a per point basis, system shall be configurable to send messages to an individual or group and shall be configurable to send different messages to different remote devices based on alarm message priority level.
   f. System must be configurable to send messages to an escalation list so that if the first device does not respond, the message is sent on to the next device after a configurable time has elapsed.
   g. Workstation shall have the ability to send manual messages allowing an operator to type in a message to be sent immediately.
   h. Workstation shall have a feature to send a heartbeat message to periodically notify users that they have communication with the system.
10. External Data Access
   a. The software shall provide the ability to expose configuration properties and real-time values through CSV files, OPC DA, OPC UA, or REST-based Web Services.
   b. The software shall provide the ability for external applications to change configuration and real-time values through OPC DA, OPC UA, or REST-based Web Services.
   c. The software shall provide the ability for external applications to access historical Trend data through CSV files or REST-based Web Services.
   d. External data access must be secured using the level of permissions configured for users and operator workstations.
   e. Web service interfaces must allow for exchanging data (object’s values, events and trend series) between workstation and external applications such as facility management systems, enterprise applications, mobile applications or other value-added services.
   f. Documentation describing web services interfaces must be included to allow external developers to write applications that leverage the data exchange.
11. Data Security
   a. The BAS software must allow that all communication paths between clients and the server are encrypted and protected against replay attacks as well as data manipulation.
   b. Any runtime data transfer between the system server and Web Server (IIS) must be allowed to be encrypted by Desigo CC.
   c. Communication between any Web Server (IIS) and the Web Clients must be allowed to be encrypted.
   d. Passwords must be handled with encrypted storage and transmission
   e. The software must support the use of public domain algorithms for cryptographic functions, including AES, DiffieHellmann, RSA, and SHA-2. No self-coded algorithms shall be allowed.
   f. All symmetrical encryption must use 256 bit AES or stronger.
   g. All asymmetrical encryption must use 2048 bit or stronger.

h. The software must support the use of commercial certificates for securing client-server communications.
i. The software must support the use of self-signed certificates to allow local deployments without the overhead of obtaining commercial certificates.
j. When using self-signed certificates, the owner of the Desigo CC system is responsible for maintaining their validity status, and for manually adding them to and removing them from the list of trusted certificates.
k. The BAS software shall be compatible with the following Virus Scanners:
   1) Kaspersky
   2) Avira
   3) McAfee
   4) Bitdefender
   5) TrendMicro Office Scan

B. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.

1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.
2. Stand-alone mode control functions operate regardless of network status. Functions include the following:

   a. Global communications.
   b. Discrete/digital, analog, and pulse I/O.
   c. Monitoring, controlling, or addressing data points.
   d. Software applications, scheduling, and alarm processing.
   e. Testing and developing control algorithms without disrupting field hardware and controlled environment.

3. Standard Application Programs:

   a. Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, anti-short-cycling, PID control, DDC with fine tuning, and trend logging.
   b. HVAC Control Programs
   c. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.
   d. Remote communications.
   e. Maintenance management.

4. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
5. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.

C. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.

1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.

2. Stand-alone mode control functions operate regardless of network status. Functions include given communications; discrete/digital, analog, and pulse I/O; and monitoring, controlling, or addressing data points.
3. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
4. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.

D. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.

1. Binary Inputs: Allow monitoring of on-off signals without external power.
2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation.
5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA).
6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
7. Universal I/Os: Provide software selectable binary or analog outputs.

E. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:

1. Output ripple of 5.0 mV maximum peak to peak.
2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

F. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:

1. Minimum dielectric strength of 1000 V.
2. Maximum response time of 10 nanoseconds.
3. Minimum transverse-mode noise attenuation of 65 dB.
4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

2.06 UNITARY CONTROLLERS

A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.

1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform scheduling with real-time clock. Perform automatic system diagnostics, monitor system and report failures.

3. ASHRAE 135 Compliance: Communicate using read (execute and initiate) and write (execute and initiate) property services defined in ASHRAE 135. Reside on network using MS/TP datalink/physical layer protocol and have service communication port for connection to diagnostic terminal unit.
4. Enclosure: Dustproof rated for operation at extreme ambient temperatures.

2.07 DDC SYSTEM WIRELESS NETWORKS

A. Use Zigbee technology to create a wireless mesh network to provide wireless connectivity for network devices at multiple system levels including communications from programmable application controllers and application-specific controllers to temperature sensors and from network controllers to programmable application controllers and application-specific controllers.

B. Installer shall design wireless networks to comply with DDC system performance requirements indicated. Wireless network devices shall co-exist on same network with hardwired devices.

C. Hardwired controllers shall be capable of retrofit to wireless devices with no special software.

D. A wireless coordinator shall provide a wireless interface between programmable application controllers, application-specific controllers, and network controllers.

E. Wireless Coordinators:

1. Each wireless mesh network shall use wireless coordinator(s) for initiation and formation of network.
2. Use direct sequence spread spectrum RF technology.
3. Operate on the 2.4-GHz ISM Band.
4. Comply with IEEE 802.15.4 for low-power, low duty-cycle RF transmitting systems.
5. FCC compliant to 47 CFR 15, Subpart B, Class A.
6. Operate as a bidirectional transceiver with sensors and routers to confirm and synchronize data transmission.
7. Capable of communication with sensors and routers up to a maximum distance of 250 feet in line of sight.
8. Include visual indicators to provide diagnostic information required for operator verification of operation.

F. Wireless Routers:

1. Each wireless mesh network shall use wireless routers with any controller to provide a wireless interface to a network controller, through a wireless coordinator.
2. Use direct sequence spread spectrum RF technology.
3. Operate on the 2.4-GHz ISM Band.
4. Comply with IEEE 802.15.4 for low-power, low duty-cycle RF transmitting systems.
5. FCC compliant to 47 CFR 15, Subpart B, Class A.
6. Operate as a bidirectional transceiver with other mesh network devices to ensure network integrity.
7. Capable of communication with other mesh network devices at a maximum distance of 250 feet in line of sight.
8. Include indication for use in commissioning and troubleshooting.

G. Wireless Temperature Sensors:

1. Wireless temperature sensors shall sense and transmit room temperatures, temperature set point, room occupancy notification and low battery condition to an associated router.

2. Use direct sequence spread spectrum RF technology.
3. Operate on the 2.4-GHz ISM Band.
4. Comply with IEEE 802.15.4 for low-power, low duty-cycle RF transmitting systems.
5. FCC compliant to CFR 15, Subpart B, Class A.
6. Include set point adjustment between 55ºF to 85ºF.
7. Multiple sensors shall be able to report to a router connected to a DDC controller for averaging or high and low selection.

H. One-to-One Wireless Network Receivers:

1. One-to-one wireless receivers shall receive wireless RF signals containing temperature data from multiple wireless room temperature sensors and communicate information to programmable application controllers or application-specific controllers.

a. Use direct sequence spread spectrum RF technology.
b. Operate on the 2.4-GHz ISM Band.
c. Comply with IEEE 802.15.4 for low-power, low duty-cycle RF transmitting systems.
d. FCC compliant to 47 CFR 15, Subpart B, Class A.
e. Operate as a bidirectional transceiver with the sensors to confirm and synchronize data transmission.
f. Capable of communication up to a distance of 200 feet.
g. Include visual indication of the following:

1) Power.
2) Receiver activity.
3) Wireless RF transmission from wireless sensors.
4) No transmission, weak signal, adequate signal or excellent signal.

I. One-to-One Wireless Network Sensors:

1. One-to-one wireless sensors shall sense and report room temperatures to one-to-one receiver.

a. Use direct sequence spread spectrum RF technology.
b. Operate on the 2.4-GHz ISM Band.
c. Comply with IEEE 802.15.4 for low-power, low duty-cycle RF transmitting systems.
d. FCC compliant to CFR 15, Subpart B, Class A.
e. Include set point adjustment between 55ºF to 85ºF.

2.08 SENSING DEVICES

A. Where feasible, provide the same sensor type throughout the project. Avoid using transmitters unless necessary.

B. Thermistors: Precision thermistors may be used in applications below 200°F. Sensor accuracy over the application range shall be 0.36°F or less between 32 to 150°F. Stability error of the thermistor over five years shall not exceed 0.25°F cumulative. A/D conversion resolution error shall be kept to 0.1°F. Total error for a thermistor circuit shall not exceed 0.5 °F.

C. Resistance Temperature Detectors (RTDs): Provide RTD sensors with platinum elements compatible with the digital controllers. Encapsulate sensors in epoxy, series 300 stainless steel, anodized aluminum, or copper. Temperature sensor accuracy shall be 0.1 percent (1 ohm) of expected ohms (1000 ohms) at 32°F. Temperature sensor stability error over five years shall not exceed 0.25°F cumulative. Direct connection of RTDs to digital controllers without transmitters is

preferred. When RTDs are connected directly, lead resistance error shall be less than 0.25°F. The total error for a RTD circuit shall not exceed 0.5°F.

D. Per ASHRAE 90.1-2016: Outdoor air, return air, mixed air, and supply air sensors shall be calibrated within the following accuracies:

1. Dry-bulb and wet-bulb temperatures shall be accurate to ±2°F over the range of 40°F to 80°F.
2. Enthalpy and the value of a differential enthalpy sensor shall be accurate to ±3 Btu/lb. over the range of 20 to 36 Btu/lb.
3. Relative humidity shall be accurate to ±5% over the range of 20% to 80% RH.

E. Temperature Sensor Details

1. Room Type: Provide the sensing element components within a decorative protective cover suitable for surrounding decor.

   a. Provide room temperature sensors with:

      1) Timed override button
      2) Setpoint adjustment lever or knob.
      3) Override switch.
      4) Digital temperature display.
      5) Insulating Bases: For temperature sensors/thermostats located on exterior walls.
      6) Guards: Locking; heavy-duty, transparent plastic; mounted on separate base.

   b. Provide a communication port or 802.11x wireless support for a portable operator interface like a notebook computer or PDA.

2. Duct Probe Type: Ensure the probe is long enough to properly sense the air stream temperature.
3. 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.
4. 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.
5. 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.

F. Occupancy Sensor: Passive infrared, with time delay, daylight sensor lockout, sensitivity control, and 180-degree field of view with vertical sensing adjustment; for flush mounting.

G. 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 °F a year.

H. 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.

I. Current Transducers: Provide current transducers to monitor motor amperage, unless current switches are shown on design drawings or point tables.

J. Shielded Space Static Pressure Sensor: The shielded space static pressure sensors shall be the S.A.P./S shielded static air probes as manufactured by Air Monitor Corporation. Shielded static pressure sensor shall be suitable for surface recessed flush mounting, complete with multiple sensing ports, pressure impulse suppression chamber, airflow shielding, all contained in an aluminum casing, with brushed finish on exposed surfaces. Probes shall be capable of sensing the static pressure in the proximity of the sensor to within 1% of the actual pressure value while being subjected to a maximum airflow of 1000 FPM from a radial source.

K. Shielded Outside Air Static Pressure Sensor: The static outside air probe shall be the S.O.A.P. as manufactured by Air Monitor Corporation or approved equal. Outdoor static pressure sensor shall be constructed of 10-gauge Type 316 stainless steel with a 2" diameter FPT connection. The outdoor air probe shall be capable of sensing the outside atmospheric air pressure to within 2% of the actual value when subjected to radial wind velocities up to 40 miles per hour with approach angles up to 30º to the horizontal.

L. Input Switches

1. Timed Local Overrides: Provide buttons or switches to override the DDC occupancy schedule programming for each major building zone during unoccupied periods, and to return HVAC equipment to the occupied mode. This requirement is waived for zones clearly intended for 24-hour continuous operation.
2. Freeze Protection Thermostats: Provide special purpose thermostats with flexible capillary elements 20-feet minimum length for coil face areas up to 40-SF. Provide longer elements for larger coils at 1-foot of element for every 4-SF 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.

M. Airflow Measuring Stations:

1. General

a. Provide one thermal airflow measuring device (AMD) for each location indicated on plans, schedules and/or control diagrams. Fan inlet measurement devices shall not be substituted for duct or plenum measurement devices indicated on the plans.
b. Each AMD shall use the principal of thermal dispersion to determine the actual or mass airflow rate of the airstream. Differential pressure-based devices, including pitot tubes, pitot arrays, piezo-rings and devices measuring the pressure drop across a louver, damper or obstruction are not acceptable.
c. Each AMD shall be provided with one or more sensor probes having one or more sensor nodes per probe.
d. Each sensor node shall consist of two hermetically sealed bead-in-glass thermistors. The airflow of each sensor node shall be determined using one self-heated and ambient temperature sensing thermistor. Devices using indirectly heated thermistors to determine the airflow rate are not acceptable. Devices using chip thermistors of any type or packaging are not acceptable. Devices using platinum wire RTDs, or similar “hot wire” devices are not acceptable.

e. Thermistors shall be potted in an engineering thermoplastic assembly using waterproof, marine epoxy and shall not be damaged by moisture, direct contact with water or exposure to atmospheric acids. Provide a copy of an independent laboratory report to verify compliance with this requirement.
f. All internal wiring in the probe tube shall be chemical and abrasion resistant Kynar® coated copper.
g. All connections to internal wires in the probe tube shall be solder joints or welds. Connectors of any type in the probe tube are not acceptable.
h. Each thermistor shall be independently calibrated to NIST traceable temperature standards to establish the resistance-temperature characteristics for the determination of airflow and temperature. Devices using interchangeable, curve-matched, thermistors are not acceptable.
i. The airflow sensing thermistor of each sensor node shall be self-heated. Devices using Indirectly heated thermistors are not acceptable.
j. Each sensor node shall be independently processed by the transmitter prior to averaging and output.
k. The specified sensor accuracy shall include the combined uncertainty of the sensor nodes and transmitter. Devices whose overall accuracy is based on individual accuracy specifications of the sensor probes and transmitter shall demonstrate compliance with the specified sensor accuracy over the entire operating range.
l. Installed accuracy shall include the uncertainty of the AMD and the additional uncertainty that results from the placement of the AMD in the airstream. The specified installed accuracy is based on the AMD being installed in accordance with manufacturers published placement and installation guidelines.
m. Transmitters shall be microprocessor-based and operate automatically after brownouts and/or transient power interruptions.
n. All printed circuit boards shall have gold plated interconnects, edge fingers, and test points.
o. Remote transmitters shall have an LCD and four-button user interface.
p. Remote transmitters shall be mounted in a location protected from moisture, rain and snow with an ambient temperature between -20 and 120°F and a humidity range between 5 and 95% RH (non-condensing). Provide a weatherproof enclosure and mount away from direct sunlight when outdoor mounting is required.
q. Probes with remote transmitters shall be “plug and play”, not require matching to the transmitter, and be provided with a UL listed, FEP jacketed, plenum rated cable and connector plug. Devices using PVC jacketed cables to connect sensor probes to the transmitter are not acceptable.
r. All components of each AMD shall be RoHS2 compliant.
s. Each AMD shall be UL/cUL listed as a final assembly.
t. Each AMD shall be FCC-Part 15 compliant. Compliance shall be demonstrated by an independent test laboratory.
u. European shipments shall be CE marked. Compliance shall be demonstrated by an independent test laboratory.
v. Devices with a BACnet network connection shall be BTL tested and listed.

2. Basis of Design:

a. Duct and plenum AMD with temperature measurement and remote transmitter: EBTRON models GTx116-P+ and GTx116e-P+.
b. Duct and plenum AMD with temperature and humidity measurement and remote transmitter: EBTRON model GTx116e-P+/H
c. Small duct and air terminal AMD with temperature measurement and remote transmitter: EBTRON model EF-x2000-T.
d. Small duct and air terminal AMD with temperature measurement and integral transmitter: EBTRON model EF-x1000-T.

e. Fan airflow and temperature measurement with remote transmitter: EBTRON models GTx108-F

N. Pressure Transmitters/Transducers:

1. Manufacturers:

a. BEC Controls Corporation.
b. General Eastern Instruments.
c. MAMAC Systems, Inc.
d. ROTRONIC Instrument Corp.
e. TCS/Basys Controls.
f. Vaisala.
g. Kele

2. Duct Differential Pressure Transmitters: Kele M30/40 and T30/40 Series, or approved equal; reliable, stable, low-air pressure transmitters with 4-20 mA outputs.
3. Duct pressure high-limit: Kele Model 1900-5-MR manual reset pressure switch is designed to monitor duct static and shut down the blower when excess pressure occurs. The switch must be manually reset before the system can start again. Switch contacts are SPDT with solder-type connections. The Model 1900-5-MR measures static pressure only, not differential pressure.
4. Air Differential Pressure Switches, Kele 1900 Series, are designed to monitor the differential pressure of air in HVAC applications. These automatic reset switches are available in ranges from 0.07" to 20" W.C. and shall have SPDT screw-type electrical connections.
5. Filter pressure drop: Kele Model A-602 air filter kit includes two static pressure tips and aluminum tubing and fittings, and it allows the Kele 1900 Series to monitor filter pressure drop.
6. Static-Pressure Transmitter: Non-directional sensor with suitable range for expected input, and temperature compensated. Accuracy: 2 percent of full scale with repeatability of 0.5 percent. Output: 4 to 20 mA. Building Static-Pressure Range: 0- to 0.25-inch wg. Duct Static-Pressure Range: 0- to 5-inch wg.
7. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.
8. Hydronic Differential Pressure Transmitters: Bell & Gossett ST Series; Setra or approved equal. Transmitter shall provide an isolated linear 4-20 mA dc output. The unit shall be accurate to ± 0.07% of full span and shall withstand over ranges up to a static pressure of 2300 psi with negligible change in output. It shall have stainless steel wetted parts with 1/4" NPT process connection. Unit shall be protected against radio frequency interference and shall have a watertight (NEMA Type 6/6P) electrical enclosure with ½" NPT conduit connection.

2.09 GAS DETECTION

A. Water Heater Room Gas Detection Device type AGS Mini Merlin CH4CO:

1. The device will be 120 Vac powered, individually powered and capable of accepting the inputs of multiple devices. The unit will clearly display the condition of an alarm and provide hazardous or toxic gas levels via ppm or % of VOL. The device shall provide a re-set and test function. The device shall incorporate dual sensor technology to detect fuel gas and CO without the requirement for additional components. The unit shall be UL certified and listed. Mount the panel per manufacturer's instructions and recommendations.
2. The device panel will be capable of transmitting alarm conditions to the BAS system through its dry contact relay output. For local activation of fans or louvers (or other

equipment), the relay will change state in alarm and revert once the alarm has been removed.

3. The device panel will be capable of operating within relative humidity ranges of 5-95% non-condensing and temperature ranges of -4° F to 140° F.
4. The device will be certified and listed to ANSI/UL 61010-1 3rd edition and CAN/CSA-C22.2 No. 61010-1.
5. For local activation of audible alarms, the transmitter shall have an on-board device able to generate an audible output of 85 dBA @ 10 ft.
6. The unit shall provide a traffic signal type colored TFT display, Green – all clear, Yellow – warning (low alarm) Red – Alarm.
7. Detector alarm levels are to be activated, and the unit is to be installed in accordance with the following parameters:
8. Carbon Monoxide (CO)

    a. Expected Operational Life: 7 years.
    b. 1st Alarm Setpoint 25 ppm
    c. 2nd Alarm Setpoint: 50 ppm

9. Natural Gas – Methane (CH4)

    a. Expected Operational Life: 7 years.
    b. 1st Alarm Setpoint: 8% of LEL, 4% of volume.
    c. 2nd Alarm Setpoint: 10% of LEL, r% of volume.

10. The sensors shall be UL listed to comply with UL2075 and incorporate filters to only look for the desired hazardous or toxic gases selected.
11. Provide a Remote Panic Button, AGS #AGSEBSTW; constructed of polycarbonate with a stainless-steel back plate capable of operating within relative humidity ranges of 0-100% and temperature ranges of -40°F to 250°F. Unit shall be clearly labeled “EMERGENCY BOILER SHUT-OFF” with 5/8” black text on yellow background with red mushroom type button. Unit will be certified and listed to UL safety standards and be ADA compliant.

B. Kele Model GDS monitor/transmitter, or equal. Microprocessor-based system for continuous effective monitoring of *combustible* gases. Provide 4-20 mA output in proportion with DPDT alarm contacts; Gas concentration display: 10-step progressive LED; Visual Indicators shall be green light “normal operation”; Provide audible alarm: 65 dbA at 3 ft; Catalytic combustion S1-type sensor; UL listed; 2-year warranty.

1. Natural Gas (Ch4) / Transmitter

    a. Detection range: 0-100% LEL (Lower Explosive Limit)
    b. Accuracy 3%
    c. Alarm set point: 25% LEL.

2. Carbon Monoxide (CO) Monitor / Transmitter:

    a. Detection range: 0-250 ppm
    b. Accuracy 3%
    c. Alarm set point 25 ppm.
    d. Mounting height: 3 to 5 feet AFF

C. Carbon-Dioxide (CO2) Sensor:

1. Manufacturers: Vaisala GMW21 and GMD20 Series, Honeywell Model C7232, MSA Airox Model 711271, GE-Telaire.

2. Analog and a relay output, use non-dispersive infrared (NDIR) technology, and feature a unique corrosion-free sensing chamber for accurate, stable CO2 sensing.
3. Gold-plated sensor for long-term calibration stability
4. Automatic Background Calibration (ABC) algorithm based on long-term evaluation to reduce required maintenance. Manufacturer recommended calibration interval shall not be less than five years.
5. Configuration as indicated: Wall mount with LCD to provide sensor readings and status information or Duct mount.

2.10 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” 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” in width or 48” 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” x 60”. 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 +122ºF.
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. Application:

1) VAV-reheat coils: two-way floating control, non-spring return.
2) CUH and Convectors: two-way two position, spring open 100%.
3) AHU main heating coils: two-way modulating control, spring open 100%.
4) Fintube radiation: zone valves. Zone valves shall have brass bodies with female NPT or sweat ends and a stainless-steel stem. Normally open zone valve actuators shall on/off and shall be available in 24VAC or 120VAC. Zone valves shall have push button for quick removal of actuator. Zone valves shall have a leakage rate of 0.1% or lower.

c. 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.
d. Valves 2½ in. and larger shall be cast iron ANSI Class 125 with guided plug and PTFE packing.
e. Water valves shall fail normally open or closed, as specified.

D. Output Switches: Control Relays; Field installed and DDC panel 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.

2.11 STATUS SENSORS

A. VFD Motor Current Switches: Veris Hawkeye H614, or equal; microprocessor based, self-learning, self-calibrating current-sensitive switching device designed for use with VFD systems. At initial power-up, the H614 automatically learns the average current on the line with no action required by the installer. Once a current is learned, the switch monitors for changes in current greater than +/-20% of the learned load. When calibrated for a given VFD system, the H614 is tolerant of gradual drifts in frequency due to expected conditions, such as an accumulation of debris in a filter, while still detecting a sudden drop due to a potential abnormal system condition (e.g., belt loss or other mechanical failure).

1. Microcontroller based learning technology - automatically learns load upon initial power-up minimizes calibration labor.
2. Automatic trip point - automatic trip point (1.5 to 150 A, 12 to 115 Hz) detects abnormal events.
3. Under and over-load - microcontroller based learning technology automatically learns load.
4. Saves space - small size fits easily inside small starter enclosures.
5. 100% solid-state no. moving parts to fail.
6. LED status
7. Induced from monitored conductor sensor power.

B. ECM Motor Current Switch: Veris H6ECM, or equal: current-sensitive switching device that monitors current (amperage) in the conductor passing through it. A change in amperage in the monitored conductor that crosses the switch (setpoint) causes the resistance of the FET status output to change state, like the action of a mechanical switch. The status output is suitable for connection to building controllers or other appropriate data acquisition equipment operating at up to 30 V. The product requires no external power supply to generate its output. The ECM is a brushless DC motor that is supplied AC power, converts that power to DC current and uses electronic switching to control the motor rotation. The ECM motor shaft speed can be reduced to save energy, resulting in lower cost and less component wear. The H6ECM is optimized to provide meaningful proof of rotation which verifies that the ECM motor is operating as expected.

1. High performance device, split-core housing.
2. Precise current trip point setting.
3. Small size - fits easily inside small enclosures.
4. Self-gripping iris for easy installation.
5. Status LEDs - for easy setup and local indication.
6. Up to 1 A status output - increased application flexibility.
7. Induced from monitored conductor sensor power.

C. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

D. 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.

2.12 ELECTRICAL POWER AND DISTRIBUTION

A. Transformers: Transformers shall conform to UL 506. For control power other than terminal level equipment, provide a fuse or circuit breaker on the secondary side of each transformer.

B. Surge and Transient Protection

1. Provide each digital controller with surge and transient power protection. Surge and transient protection shall consist of the following devices, installed externally to the controllers.
2. Power Line Surge Protection: Provide surge suppressors on the incoming power at each controller or grouped terminal controllers. Surge suppressors shall be rated in accordance with UL 1449, have a fault indicating light, and conform to the following:

    a. The device shall be a transient voltage surge suppressor, hard-wire type individual equipment protector for 120 VAC/1 phase/2 wire plus ground.
    b. The device shall react within 5 nanoseconds and automatically reset.
    c. The voltage protection threshold, line to neutral, shall be no more than 211 volts.
    d. The device shall have an independent secondary stage equal to or greater than the primary stage joule rating.
    e. The primary suppression system components shall be pure silicon avalanche diodes.
    f. The secondary suppression system components shall be silicon avalanche diodes or metal oxide varistors.
    g. The device shall have an indication light to indicate the protection components are functioning.
    h. All system functions of the transient suppression system shall be individually fused and not short circuit the AC power line at any time.
    i. The device shall have an EMI/RFI noise filter with a minimum attenuation of 13 dB at 10 kHz to 300 MHz
    j. The device shall comply with IEEE C62.41.1 and IEEE C62.41.2, Class "B" requirements and be tested according to IEEE C62.45.
    k. The device shall be capable of operating between -20 °F and 122 °F.

3. Telephone and Communication Line Surge Protection: Provide surge and transient protection for DDC controllers and DDC network related devices connected to phone and network communication lines. The device shall provide continuous, non-interrupting protection, and shall automatically reset after safely eliminating transient surges. The protection shall react within 5 nanoseconds using only solid-state silicon avalanche technology. The device shall be installed at the distance recommended by its manufacturer.
4. Controller Input/Output Protection: Provide controller inputs and outputs with surge protection via optical isolation, metal oxide varistors (MOV), or silicon avalanche devices. Fuses are not permitted for surge protection.

C. Wiring: Provide complete electrical wiring for the DDC System, coordinate line of demarcation with Division 26. Unless indicated otherwise, provide all normally visible or otherwise exposed wiring in conduit. Where conduit is required, control circuit wiring shall not run in the same conduit as power wiring over 100 volts. Circuits operating at more than 100 volts shall be in accordance with Division 26. Run all circuits over 100 volts in conduit, metallic tubing, covered metal raceways, or armored cable. Use plenum-rated cable for circuits under 100 volts in enclosed spaces. Examples of these spaces include HVAC plenums, within walls, attics, or above suspended ceilings.

D. Power Wiring: The following requirements are for field-installed wiring:

1. Wiring for 24 V circuits shall be insulated copper 18 AWG minimum and rated for 300 VAC service.

2. Wiring for 120 V circuits shall be insulated copper 14 AWG minimum and rated for 600 VAC service.

E. Analog Signal Wiring: Field-installed analog signal wiring shall be 18 AWG single or multiple twisted pair. Each cable shall be 100 percent shielded and have a 20 AWG drain wire. Each wire shall have insulation rated for 300 VAC service. Cables shall have an overall aluminum-polyester or tinned-copper cable-shield tape.

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 of 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 provided at the expense of this contractor.

3.02 INSTALLATION

A. Provide software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation. Connect and configure equipment and software to achieve sequence of operation specified.

B. 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 DDC systems.

C. Provide equipment, piping, and wiring/raceway parallel to building lines (i.e., horizontal, vertical, and parallel to walls) wherever possible.

D. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.

E. 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.

F. 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.

G. 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” above the floor to meet ADA requirements.

1. Provide guards on room temperature sensors as shown on the plans.

H. Duct Temperature Sensors

1. Probe Type: Provide a gasket between the sensor housing and the duct wall. Seal the duct penetration airtight. 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”. 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.

I. 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.

J. 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.

K. Meters: Locate meters as indicated. Connect each meter output to the DDC system, to measure both instantaneous and accumulated energy usage.

L. Provide automatic dampers according to Section 23 31 13 "Ductwork."

M. Provide damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

N. Provide labels and nameplates to identify control components according to Section 23 05 00 "Common Work Results".

O. Provide hydronic instrument wells, valves, and other accessories according to Section 23 21 13 “Hydronic HVAC Piping". Provide thermowells for sensors measuring piping, tank, or pressure vessel temperatures. Locate wells to sense continuous flow conditions. Do not install wells using extension couplings. Where piping diameters are smaller than the length of the wells, provide wells in piping at elbows to sense flow across entire area of well. Wells shall not restrict flow area to less than 70 percent of pipe area. Increase piping size as required to avoid restriction. Provide thermal conductivity material within the well to fully coat the inserted sensor.

P. Provide duct volume-control dampers according to Section 23 31 13 "Ductwork"

3.03 WIRING

A. All control and interlock wiring shall comply with national and local electrical codes, and Division 26 of this specification. Where the requirements of this section differ from Division 26, the requirements of Division 26 shall take precedence.

B. NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway according to NEC and Division 26 requirements. Low-voltage wiring shall meet NEC Class 2 requirements. Low-voltage power circuits shall be sub-fused when required to meet Class 2 current limit.

C. Where NEC Class 2 (current-limited) wires are in concealed and accessible locations, including ceiling return air plenums, approved cables not in raceway may be used if cables are UL listed for the intended application.

D. Do not install Class 2 wiring in raceways containing Class 1 wiring. Boxes and panels containing high-voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).

E. Where Class 2 wiring is run exposed, wiring is to be run parallel along a surface or perpendicular to it and neatly tied at 10 ft intervals.

F. Where plenum cables are used without raceway, they shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceiling suspension systems.

G. All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be at a terminal block.

H. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.

I. Maximum allowable voltage for control wiring shall be 120 V. If only higher voltages are available, the contractor shall provide step-down transformers.

J. All wiring shall be installed as continuous lengths, with no splices permitted between termination points.

K. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations.

L. Size of raceway and size and type of wire type shall be the responsibility of the contractor in keeping with the manufacturer’s recommendations and NEC requirements, except as noted elsewhere.

M. Include one pull string in each raceway in 1-inch or larger.

N. Use color-coded conductors throughout with conductors of different colors.

O. Control and status relays shall be in designated enclosures only. These enclosures include packaged equipment control panel enclosures unless they also contain Class 1 starters.

P. Conceal all raceways except within mechanical, electrical, or service rooms.

Q. Secure raceways with raceway clamps fastened to the structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.

R. Adhere to this specification's Division 26 requirements where raceway crosses building expansion joints.

S. Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of vertical raceways.

T. The contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.

U. Flexible metal raceways and liquid-tight flexible metal raceways shall not exceed 3-feet in length and shall be supported at each end. Flexible metal raceway less than ½ in. electrical trade size shall not be used. In areas exposed to moisture, including chiller and boiler rooms, liquid-tight, flexible metal raceways shall be used.

V. Raceway must be rigidly installed, adequately supported, properly reamed at both ends, and left clean and free of obstructions. Raceway sections shall be joined with couplings (according to code). Terminations must be made with fittings at boxes. Ends not terminating in boxes shall have bushings installed.

COMMUNICATION WIRING

A. The contractor shall adhere to the items listed in the "Wiring" article in Part 3 of the specification. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling.

B. Do not install communication wiring in raceways and enclosures containing Class 1 or other Class 2 wiring.

C. Maximum pulling, tension, and bend radius for the cable installation, as specified by the cable manufacturer, shall not be exceeded during installation.

D. Contractor shall verify the integrity of the entire network following cable installation. Use appropriate test measures for each cable.

E. When a cable enters or exits a building, a lightning arrestor must be installed between the lines and ground. The lighting arrestor shall be installed according to manufacturer’s instructions.

F. All runs of communication wiring shall be unspliced length when that length is commercially available.

G. All communication wiring shall be labeled to indicate origination and destination data.

H. Grounding of coaxial cable shall be in accordance with NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

I. BACnet MS/TP communications wiring shall be installed in accordance with ASHRAE/ANSI Standard 135.
Fiber Optic Cable: 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. All cabling and associated components 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. DDC Verification:

1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check flow instruments. Inspect tag number and line and bore size and verify that inlet side is identified and that meters are installed correctly.
5. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
6. Check temperature instruments and material and length of sensing elements.
7. Check control valves. Verify that they are in correct direction.
8. Check DDC system as follows:

    a. Verify that DDC controller power supply is from emergency power supply, if applicable.
    b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
    c. Verify that spare I/O capacity has been provided.
    d. Verify that DDC controllers are protected from power supply surges.

C. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.06 ADJUSTING

A. Calibrating and Adjusting:

1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.

3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. 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.

5. Flow:

    a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
    b. Manually operate flow switches to verify that they make or break contact.

6. Pressure:

    a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
    b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.

7. 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.

8. 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.
9. 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.
10. Outdoor Air Dampers. Prior to occupancy, each ventilation system shall be tested to demonstrate that outdoor air dampers operate in accordance with the system design.
11. Provide diagnostic and test instruments for calibration and adjustment of system.
12. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature and humidity 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. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Section 01 79 00 "Demonstration and Training."

B. Provide a qualified instructor (or instructors) with five years minimum field experience with the installation and programming of similar BACnet DDC systems. Orient training to the specific systems installed. Coordinate training times with the Owner. Training shall take place at the job site.

C. This training shall last a minimum of four (4) hours and shall be conducted at the DDC system workstation, at a notebook computer connected to the DDC system in the field, and at other site locations as necessary. Upon completion of the Training, each trainee should fully understand the project's DDC system operation. The training session shall include the following:

D. Provide basic control system fundamentals training.

1. This project's list of control system components
2. This project's list of points and objects
3. This project's device and network communication architecture
4. This project's sequences of control, and:
5. Alarm capabilities
6. Trending capabilities
7. Troubleshooting communication errors
8. Troubleshooting hardware errors

E. Provide additional project-specific training:

1. A walk-through tour of the mechanical system and the installed DDC components (controllers, valves, dampers, surge protection, switches, thermostats, sensors, etc.)
2. A discussion of the components and functions at each DDC panel
3. Logging-in and navigating at each operator interface type.
4. Using each operator interface to find, read, and write to specific controllers and objects.
5. Modifying and downloading control program changes
6. Modifying setpoints
7. Creating, editing, and viewing trends
8. Creating, editing, and viewing alarms
9. Creating, editing, and viewing operating schedules and schedule objects
10. Backing-up and restoring programming and data bases
11. Modifying graphic text, backgrounds, dynamic data displays, and links to other graphics
12. Creating new graphics and adding new dynamic data displays and links.
13. Alarm and Event management
14. Adding and removing network devices

3.08 TEST AND BALANCE SUPPORT

A. The controls contractor shall coordinate with and provide on-site support to the test and balance (TAB) personnel This support shall include:

1. On-site operation and manipulation of control systems during the testing and balancing.
2. Control setpoint adjustments for balancing all relevant mechanical systems.
3. Tuning control loops with setpoints and adjustments determined by TAB personnel.

3.09 CONTROLS SYSTEM OPERATOR'S MANUALS

A. Provide three electronic and printed copies of a Controls System Operators Manual. The manual shall be specific to the project, written to actual project conditions, and provide a complete and

concise depiction of the installed work. Provide information in detail to clearly explain all operation requirements for the control system.

B. Provide with each manual: CDs of the project's control system drawings, control programs, data bases, graphics, and all items listed below. Include gateway back-up data and configuration tools where applicable.

C. Provide printed manuals in sturdy 3-ring binders with a title sheet on the outside of each binder indicating the project title, project location, contract number, and the controls contractor name, address, and telephone number. Each binder shall include a table of contents and tabbed dividers, with all material neatly organized. Manuals shall include the following:

1. A copy of the as-built control system (shop) drawings set, with all items specified under the paragraph "Submittals." Indicate all field changes and modifications.
2. A copy of the project's mechanical design drawings, including any official modifications and revisions.
3. A copy of the project's approved Product Data submittals provided under the paragraph "Submittals."
4. A copy of the project's approved Performance Verification Testing Plan and Report.
5. A copy of the project's approved final TAB Report.
6. Printouts of all control system programs, including controller setup pages if used. Include plain-English narratives of application programs, flowcharts, and source code.
7. Printouts of all physical input and output object properties, including tuning values, alarm limits, calibration factors, and set points.
8. A table entitled "AC Power Table" listing the electrical power source for each controller. Include the building electrical panel number, panel location, and circuit breaker number.
9. The DDC manufacturer's hardware and software manuals in both print and CD format with printed project-specific labels. Include installation and technical manuals for all controller hardware, operator manuals for all controllers, programming manuals for all controllers, operator manuals for all workstation software, installation and technical manuals for the workstation and notebook, and programming manuals for the workstation and notebook software.
10. A list of qualified control system service organizations for the work provided under this contract. Include their addresses and telephone numbers.
11. A written statement entitled "Software Upgrades" stating software and firmware patches and updates will be provided upon request at no additional cost to the Owner for a minimum of two years from contract acceptance. Include a table of all DDC system software and firmware provided under this contract, listing the original release dates, version numbers, part numbers, and serial numbers.

3.10 CLEANING

A. The contractor shall clean up all debris resulting from his/her activities daily. The contractor shall remove all cartons, containers, crates, etc., under his/her control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.

B. At the completion of work in any area, the contractor shall clean all work, equipment, etc., keeping it free from dust, dirt, and debris, etc.

C. At the completion of work, all equipment furnished under this section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be required to match the adjacent areas. Any cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

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

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 68ºF, would turn ON at 68°F and OFF at 70°F since it is a cooling function. A heating lockout setpoint of 50 ºF 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.

1.05 EQUIPMENT STAGING AND ROTATION

A. All parallel equipment shall be lead/lag or lead/standby rotated to maintain even wear.

B. Provide per ASHRAE Guideline 36, Paragraph 5.1.15: "Equipment Staging and Rotation".

C. Two runtime points shall be defined for each equipment:

   1. Lifetime Runtime: The cumulative runtime of the equipment since equipment start-up. This point shall not be readily resettable by operators. Lifetime Runtime shall be stored to a software point on the control system server, so the recorded value is not lost due to controller reset, loss of power, programming file update, etc.
   2. Staging Runtime: An operator resettable runtime point that stores cumulative runtime since the last operator reset. Staging Runtime provides a resettable runtime counter, which allows for reset of the staging runtime hours used for lead/lag or lead/standby rotation between maintenance intervals or equipment replacement while maintaining a separate log of the Lifetime Runtime.

D. Lead/lag equipment: Unless otherwise noted, identical parallel staged equipment (e.g., pumps) shall be lead/lag alternated when more than one is OFF or more than one is ON so that the equipment with the most operating hours as determined by Staging Runtime is made the last stage equipment and the one with the least number of hours is made the lead stage equipment.

This strategy effectively makes it such that equipment are not “hot swapped”, e.g., a pump would not be started and another stopped during operation just for runtime equalization.

E. Lead/standby equipment:
1. Unless equipment runs continuously, parallel equipment that are 100% redundant shall be lead/standby alternated when more than one of the equipment is off so that the equipment with the most operating hours as determined by Staging Runtime is made the last stage equipment and the one with the least number of hours is made the earlier stage equipment.
2. If equipment runs continuously, lead/standby positions shall switch at an adjustable day of the week and time (e.g., every Tuesday at 10:00 am) based on Staging Runtime; standby equipment shall first be started and proven on before former lead equipment is changed to standby and shut off.
3. Variable speed fans and pumps shall have a deceleration rate of 1 Hz/second or slower set in BAS logic when disabled to prevent nuisance trips of operating equipment (e.g., chillers).

F. Exceptions to Lead/lag and Lead/standby rotation

1. Operators with appropriate access level shall be able to manually command staging order via software points but not overriding the In-Alarm or Hand-Operation logic in the following subsections.

    a. Staging order changes initiated via operator override shall be instituted as part of normal staging events.
    b. Staging order shall remain overridden until released by operators.

2. Faulted Equipment:

    a. A faulted equipment is any equipment commanded to run that is either not running or unable to perform its required duty. If an operating equipment has any fault condition described subsequently, a Level 2 alarm shall be generated, and a response shall be triggered.
    b. Fans and Pumps: Status point not matching its on/off point for 3 seconds after a time delay of 15 seconds while the equipment is commanded on.

3. Upon identification of a fault condition:
    For fans, and pumps:
    a. The next commanded off equipment in the staging order, Equipment “B”, shall be commanded on while alarming Equipment “A” remains commanded on.
    b. If Equipment “B” fails to prove status (i.e., it also goes into alarm), it shall remain commanded on and the preceding step shall be repeated until the quantity of equipment called for by the current stage has proven on, or there are no more available equipment.
    c. Set alarming equipment to the last positions in the lead/lag or lead/standby staging order sequenced reverse chronologically (i.e., the equipment that alarmed most recently is sent to last position).
    d. Staging order of non-alarming equipment shall follow the even wear logic. Equipment in alarm can only automatically move up on the staging order if another equipment goes into alarm.
    e. Equipment in alarm shall run if so called for by the lead/lag or lead/standby staging order and present stage.

4. Hand Operation. If a piece of equipment is on-in-hand (e.g., via an HOA switch or local control of VFD), the equipment shall be set to the lead device, and a Level 4 alarm shall be generated. The equipment will remain as lead until. Hand operation is determined by the following:

a. Fans and Pumps: Status point not matching its on/off point for 15 seconds after a time delay of 60 seconds when the equipment is commanded off.

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
Locker Rooms	70°F	78°F
Mechanical Spaces	55°F	95°F
IT Rooms	55°F	76°F
Electrical Closets	55°F	78°F
Stairwells	60°F	None
Storage Rooms	60°F	85°F
Vestibules	55°F	85°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 DEDICATED OUTDOOR AIR SYSTEM (DOAS) W/PACKAGED CONTROLS

A. DOAS unit shall be enabled by the BAS.

B. Factory DDC controller provided by DOAS unit manufacturer, coordinate with Section 23 74 33. The factory controller includes the following:
   1. Supply & exhaust fan control
   2. Supply air temperature.
   3. Heating
   4. Cooling
   5. Dehumidification
   6. Energy Recovery Wheel
   7. VAV control

C. Provide monitoring and alarm points as per the manufacturer's Points List.

D. Smoke detectors: Provide per Smoke Detector paragraphs hereinafter.

E. Freeze Protection: Upon signal from the freeze-stat, or if SA temperature drops below 40°F for 5 minutes, shut down the unit. If a freeze-protection shutdown is triggered by a low air temperature sensor reading, it shall remain in effect until it is manually reset.

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. 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.

C. 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 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. 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.

E. 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.

F. 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.

2.05 TERMINAL UNITS – SPECIFIC REQUIREMENTS

A. Terminal Heating Units, 2-position valve controlled – (Examples: Fintube, convectors, radiant heating panels):

1. Input Device: Electronic temperature sensor.
2. Open/close valve to maintain temperature.
3. Heating Hot-Water Plant Requests. Send the heating hot-water plant that serves the coil a heating hot-water plant request as follows:

a. If the space does not heat to setpoint within 5 minutes, send 1 request.
b. If there are no requests for 5 minutes, send 0 requests.

B. Vestibules: Heating for vestibules shall include automatic controls capable of and configured to shut OFF the heating system when OA temperatures are above 45°F.

C. Electric Heaters:

1. Input Device: Electronic temperature sensor.
2. Upon a drop-in space temperature below the heating setpoint, the heat shall be energized.

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. Provide VAV Terminal Unit with Reheat Control logic as shown in Figure 5.6.5 and described in the following subsections.

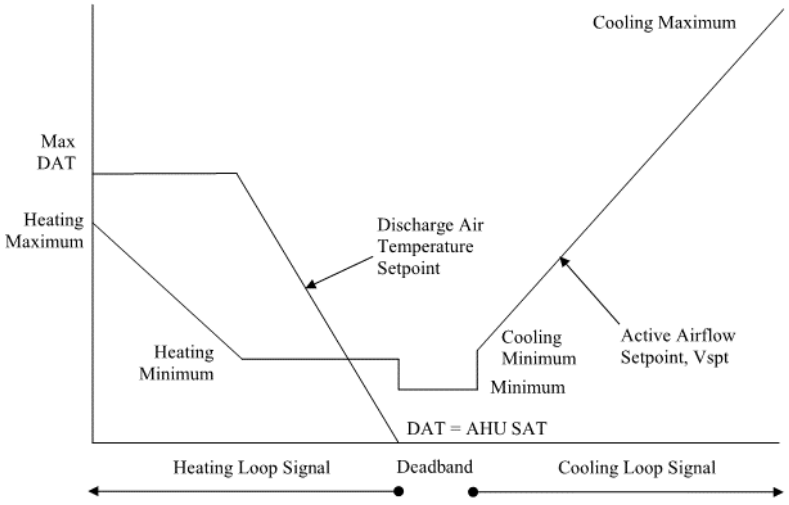


Figure 5.6.5 Control logic for VAV reheat zone.

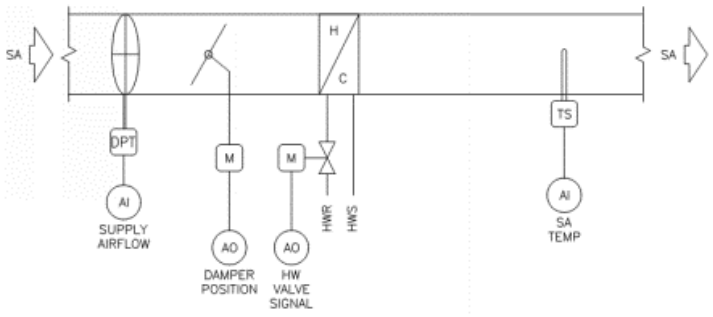
1. Provide a discharge air temperature sensor.
2. When the Zone State is cooling, the cooling-loop output shall be mapped to the active airflow setpoint from the cooling minimum endpoint to the cooling maximum endpoint. Heating coil is disabled unless the DAT is below the minimum setpoint (50°F).

    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 MaxΔT 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.



C. 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.

D. 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).

E. 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.

3. If There Is a Hot-Water Coil, Hot-Water Reset Requests

a. If the DAT is 30°F less than the setpoint for 5 minutes, send 3 requests.
b. Else if the DAT is 15°F less than the setpoint for 5 minutes, send 2 requests.
c. Else if HW valve position is greater than 95%, send 1 request until the HW valve position is less than 85%.
d. Else if the HW valve position is less than 95%, send 0 requests.

4. If There Is a Hot-Water Coil and Heating Hot-Water Plant Requests. Send the heating hot-water plant that serves the zone a heating hot-water plant request as follows:

a. If the HW valve position is greater than 95%, send 1 request until the HW valve position is less than 10%.
b. Else if the HW valve position is less than 95%, send 0 requests.

F. 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.).

G. 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 50º F (adj.).

2.07 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) Control Rooms: 960
4) Conference: 1,200
5) Offices: 890
6) Multi-Purpose, Auditorium, Gyms: 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.

B. Unoccupied Mode: VAV boxes at minimum position.

2.08 GAS DETECTION

A. Provide in accordance with the manufacturer's requirements at least one approved fuel gas detector in every room containing an appliance fueled by propane, natural gas. Provide a dual gas detector as specified in Section 23 09 00. The internal relay outputs shall change state communicating the alarm condition to the BAS
1. Low / 1st Alarm Setpoint: Level 2.
2. High / 2nd Alarm Setpoint: Level 1. De-energize the power output to the gas valve and electrical-contactor isolating the gas supply to the boiler room and the electrical power to the appliances.
3. Remote Panic Button input shall activate Level 1 alarm.

B. Commissioning

1. After installation, test equipment to demonstrate operation of functions described above by utilizing sample test gas.
2. Provide testing kits (including gas bottles) for testing.
3. A testing procedure to ensure proper control wiring may be used by utilizing the internal manual test function on the detectors.

2.09 DOMESTIC HOT WATER

A. Common Requirements:
1. Domestic Hot Water Recirculation Pumps: Operate the pumps only when the DHW temperature in the return line near the DHW heater falls below 125°F. Pump cycling shall be controlled by a return line aquastat set at 120°F with a 5°F deadband.
2. BAS shall monitor the following:
   a. Tank temperature of each DHW heater.
   b. DHW supply: The digital mixing valve (specified in 221116) has a BACnet card. Monitor and Level 1 alarm if the DHW supply temperature to the building exceeds setpoint for more than 20 minutes.
   c. DHW return.
   d. Monitor status and provide pump fault alarms per Paragraph 1.3 “Alarms”. Current status-switches shall prove the operation of pumps.

B. Gas-fired: DHW manufacturer built-in controls.

2.10 MISCELLANEOUS POINTS

A. Water Leak Detection: Comes with water heater.

END OF SECTION

SECTION 23 21 13

PART 1 -

HYDRONIC HVAC PIPING

PART 2 - GENERAL

2.01 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 "Hydronic Pumps" for pumps, motors, and accessories.
3. Division 23 controls section for temperature-control valves and sensors.
4. Appendix B: DOC Standard Terms and Conditions (BABAA).

2.02 SUMMARY

A. This Section includes piping and specialties for hydronic HVAC piping.

2.03 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Piping
2. Hydronic specialties
3. Chemical treatment.

B. Delegated-Design Submittal: Braided Expansion Loops

1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
2. Locations of pipe anchors and alignment guides and expansion joints and loops.

C. Product Certifications: All product manufacturers shall provide written certification of BABAA compliance for all materials submitted inclusive of related accessories and components.

2.04 INFORMATIONAL SUBMITTALS

A. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

2.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

2.06 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to the ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Qualify soldering processes, procedures, and solderers for copper and copper alloy pipe and tube in accordance with ASTM B 828.

C. Qualify brazing processes for copper and copper alloy pipe and tube according to ANSI/AWS C3.4.

D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

E. HVAC Water-Treatment Service Provider Qualifications: An experienced HVAC water-treatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.

2.07 COORDINATION

A. 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.

B. Coordinate layout and installation of hydronic piping and suspension system components with other construction.

C. Coordinate pipe sleeve installations and penetrations with other trades.

D. Coordinate pipe fitting pressure classes with products specified in related Sections.

PART 3 - PRODUCTS

3.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Grooved Mechanical-Joint Fittings and Couplings:

a. Victaulic Company of America.
b. Anvil
c. Grinnell Corporation.

2. Balancing Valves:

a. Griswold Controls.
b. ITT Bell & Gossett
c. Taco, Inc.
d. Tour & Anderson
e. IMI Flow Design
f. Griswold Controls
g. Watts Industries Inc.
h. Caleffi
i. Nexus

3. Hydronic Pressure-Reducing Valves:

a. Amtrol, Inc.
b. Armstrong Pumps, Inc.
c. Conbraco Industries, Inc.
d. ITT Bell & Gossett
e. Spence
f. Caleffi
g. Watts Industries, Inc.

4. Safety Valves:

a. Amtrol, Inc.
b. Armstrong Pumps, Inc.
c. Conbraco Industries, Inc.
d. ITT McDonnell & Miller.
e. Kunkle Valve Division.
f. Spence
g. Caleffi
h. Watts Industries Inc.

5. Air Vents and Vacuum Breakers:

a. Armstrong International, Inc.
b. Barnes & Jones, Inc.
c. ITT Hoffman
d. Caleffi
e. Spirotherm
f. Spirax Sarco, Inc.

3.02 PIPING MATERIALS

A. General: Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials.

3.03 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. DWV Copper Tubing: ASTM B 306, Type DWV.

C. Fitting Standard: Copper fittings shall conform to ASME B16.18, ASME B16.22 or ASME B16.26.

D. Press Fitting: Viega Pro Press - 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). Provide a smart connect feature to 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 shall be to provide the installer quick and easy identification of connections which have not been pressed prior to putting the system into operation.

E. Wrought-Copper Unions: ASME B16.22.

F. Solder Filler Metals: ASTM B 32, 95-5 tin antimony.

G. Brazing Filler Metals: AWS A5.8, Classification BAg-1 (silver).

3.04 HYDRONIC VALVES

A. Ball Valves

1. Threaded Ends 4" and Smaller: 150 psi WP and 600 psi non-shock CWP, forged brass full-port or cast bronze two-piece body, hard chrome plated forged brass ball, true adjustable packing nut ("O"-ring only type stem seal not acceptable), blow-out proof stem: Watts FBV-3C series/B6080 series, Hammond 8501, Nibco T-585-70, Milwaukee BA100, Apollo 70-Series, or approved equal.
2. Soldered Ends 3" and Smaller: 150 psi WP and 600psi non-shock CWP, full-port cast bronze or forged brass two-piece body, hard chrome plated forged brass ball, true adjustable packing nut ("O"-ring only type stem seal not acceptable), blow-out proof stem: Watts FBVS-3C series/B6081 series, Hammond 8511, Nibco S-585-70, Milwaukee BA150, Apollo 70-Series, approved or equal.
3. Comply with MSS SP-110.

B. Butterfly Valves

1. Basis of Design: Center Line Series 200; Lug Type, cast iron, drilled and tapped lug body, ductile iron disc, 416SS shaft, bronze bushing, EPDM seat.
2. Valve bodies shall have extended necks to provide for 2-1/4" insulation as needed.
3. Comply with MSS SP-67.
4. Compatible with ANSI 125/150 flanges. Dead-end capacity to 200 psi.
5. Operators: 6” and smaller: handle with infinite adjustment; 8” and larger: gear w/balance-stop hand wheel. Valves located 7 feet or higher: provide gear/chain wheel.
6. Approved Manufacturers: Watts, Hammond, Nibco, Milwaukee, or approved equal.

C. Bronze Globe Valves, Class 125:

1. Description:

a. Standard: MSS SP-80, Type 1.

b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint.
e. Stem and Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron.

D. Bronze Globe Valves, Class 150:

1. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: Bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron.

E. Iron Globe Valves, Class 125:

1. Description:

a. Standard: MSS SP-85, Type I.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Packing and Gasket: Asbestos free.
g. Operator: Handwheel or chainwheel.

F. Iron Globe Valves, Class 250:

1. Description:

a. Standard: MSS SP-85, Type I.
b. CWP Rating: 500 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Packing and Gasket: Asbestos free.
g. Operator: Handwheel or chainwheel.

G. Wafer Check valves: Provide wafer style, butterfly type, spring actuated check valves designed to be installed with gaskets between two standard Class 125 flanges. Construct iron body valves with pressure containing parts of valves with materials conforming to ANSI/ASTM A 126, Grade B. Support hanger pin by removable side plug; Class 125, cast iron body, stainless steel trim, bronze disc, Buna-N seal:, Watts BF/DBF series, Metraflex 700 Series, Nibco W920-W, Stockham WG970, Hammond 9253, Milwaukee 1400, or approved or equal.

H. 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. Comply with the

following standards for design, workmanship, material and testing: Bronze Valves: MSS SP – 80; Cast Iron Valves: MSS SP – 71.

2. Construct valves of pressure casting free of any impregnating materials. Construct disc and hanger as one piece. Support hanger pins by removable side plug.
3. Threaded Ends 2" and Smaller: Class 125, bronze body, screwed cap, Teflon disc: Hammond IB904, Nibco T-413Y, Stockham B320T, Milwaukee 509 or approved equal.
4. Soldered Ends 2" and Smaller: Class 125, bronze body, screwed cap, Teflon disc: Hammond IB912, Nibco S-413-Y, Stockham B310T, Milwaukee 511 or approved equal.
5. Flanged Ends 2-1/2" and Larger: Class 125, iron body, bronze mounted, horizontal swing, cast-iron disc: Hammond IR1124, Nibco F918-B, Stockham G931, Milwaukee F2974 or approved equal.

I. Pressure-Reducing Valves: Diaphragm-operated, bronze or brass body with low inlet pressure check valve, inlet strainer removable without system shutdown, and non-corrosive valve seat and stem. Select valve size, capacity, and operating pressure to suit system. Valve shall be factory set at operating pressure and have capability for field adjustment.

J. ASME Safety Relief Valves: Bell & Gossett A-434D, or equal; diaphragm-operated, bronze or brass body with brass and rubber, wetted, internal working parts; shall suit system pressure and heat capacity and shall comply with the ASME Boiler and Pressure Vessel Code, Section IV. The fluid shall not discharge into the spring chamber. The valve shall have a low blow-down differential. The valve seat and all moving parts exposed to the fluid shall be of non-ferrous material.

3.05 HOOKUPS AND BALANCING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following.

1. Nexus (Basis of Design)
2. IMI Flow Design
3. HCI
4. Hays
5. Griswold
6. Victaulic
7. Taco
8. Bell & Gossett

B. Minimum Requirements Per Coil Installation:

1. Automatic Flow Control Valve (AFCV)
2. Y-strainer.
3. Temperature Control Valve (TCV) – see 230900.
4. Union connections at coil and TCV.
5. Air vent on return side.
6. Blowdown/drain valve on supply side.
7. Pressure/temperature test plugs across coil and TCV.
8. Full port, union end ball valves or butterfly valves for shutoff.

C. Materials Of Construction (2½” and smaller, except as noted)

1. Brass or stainless-steel metals.
2. Teflon, EPDM or FKM seals.

D. Installation

1. Installation shall conform to basic piping methods specifications.
2. All components shall be isolated by shutoff valves.
3. Flexible hoses shall be installed at coil connections as shown in the plans or at the option of the mechanical contractor.
4. Union tailpieces may be used to reduce pipe sizes to match coil and TCV valve sizes.
5. Pressure/Temperature test plugs shall be installed across coil.
6. A Y-strainer or combination strainer and valve shall be installed on the supply side.
7. Unions shall be used to isolate the coil, AFCV and TCV.

E. Shutoff Valves (2½" and smaller) shall be forged brass ball valves, Nexus Model UX:

1. A one-piece body rated at 250 psi WP, 325° F.
2. Interchangeable union ends with FKM O-ring seal (ground joint is not acceptable).
3. Multiple ¼" tapped ports for test plugs, vent, and/or drain.
4. Blowout-proof stem with dual KFM O-ring seals.
5. Hard chrome plated stainless steel ball with Teflon seats.

F. Shutoff Valves (2½" and larger) shall be lug pattern butterfly valves, Nexus Model BV:

1. A minimum of 225 psi WP, 250° F.
2. 125# Class lug pattern cast or ductile iron body.
3. EPDM cartridge seat, 416 stainless steel one-piece shaft, and 304 stainless steel disc.
4. Top and bottom shaft bushings.
5. Provide an infinite position chrome plated steel top plate for balancing purposes.
6. Epoxy coated body.

G. Automatic Flow Control Valves shall be non-clogging design, Nexus Model UM:

1. The flow cartridge's non-clogging service design shall include no metal-to-metal contact, no segmented ports, and incorporate a flow nozzle and a metering disc controlled by a pressure compensating spring.
2. The flow cartridge shall be a single assembly, constructed with stainless steel moving parts and be accessible without removing the valve from the piping (½" thru 2½" brass valves).
3. The flow cartridge shall be 100% factory flow tested and calibrated to maintain an accuracy of ±5%; the accuracy shall be 100% maintained over the operating pressure range.
4. The flow cartridge shall carry a limited lifetime material warranty.
5. Valves (2½" and smaller) shall be a forged brass Y-pattern body with ball valve, (2) pressure/temperature ports, a tag indicating the model, flow rate and PSID range, blowout proof stem with dual FKM O-ring seals, interchangeable union end with FKM O-ring seal, hard chrome plated brass ball with Teflon seats, and rated at 250 psi WP, 325° F.
6. Valves (2½" +) shall be a wafer style or 125# / 150# Class flanged cast iron body with (2) pressure/temperature ports, a tag indicating the model, flow rate and PSID range; able to incorporate a drain and/or vent as required; and rated at 175 psi WP, 250° F.

H. Temperature Control Valves, ref. Section 23 09 00 & 230993.

I. Combination Strainer/Ball Valves (2½" and smaller) used for supply side shutoff and strainer requirements shall be forged brass construction, Nexus Model UY:

1. A minimum rating of 250 WOG, 325° F.

2. Interchangeable union end with FKM O-ring seal.
3. Multiple ¼" tapped ports for test plugs, vent, or other accessories.
4. Blowout proof stem with dual FKM O-ring seals.
5. Hard chrome plated stainless steel ball with Teflon seats.
6. A 20 mesh 304 stainless steel filter screen, accessible without affecting the valve piping.
7. A port in the filter cap for a blowdown/drain valve.

J. Y-Strainers (2½" and smaller) shall be forged brass body, Nexus Model UYX:

1. ¼" tapped accessory ports.
2. A rating of 250 WOG, 325° F.
3. A 20 mesh 304 stainless steel filter screen, removable without affecting the strainer piping.
4. A port in the filter cap for a blowdown/drain valve.

K. Blowdown/Drain Valves shall be forged brass ball valve construction, Nexus Model BD:

1. A minimum rating of 250 WOG, 325° F.
2. Blowout proof stem with dual FKM O-ring seals.
3. Hard chrome plated brass ball with Teflon seats.
4. A ¾" hose end and nylon / brass cap with retainer to protect threads.

L. Unions (2" and smaller) shall be forged brass, Nexus Model UU:

1. A minimum of 250 psi WP, 325° F.
2. Multiple ¼" tapped ports for test plugs, vent and/or drain valves.
3. FKM O-ring seal.

M. Accessories to coil piping components shall conform to the following:

1. Nexus PT Pressure/Temperature test plugs shall be rated for 1000 psi, 325° F, with brass body, Nordel check plugs, and sealed cap.
2. Flexible hoses shall be designed for water, and fire retarding conform to ASTM codes E84-00, with stainless steel outer braid.
3. Hoses (½" thru 1"), Nexus UFHF.

    a. Shall have a Kevlar reinforced EPDM tube core, brass end fittings, and designed for a working pressure of 400 psi, 248°F.
    b. Provide dual union or swivel end fittings.

4. Hoses (1¼" thru 2"), Nexus UFHM:

    a. Shall have Rayon reinforced EPDM tube core, brass end fittings, and designed for a working pressure of 300 psi, 248° F. The (2½") hose shall have stainless steel outer braid and carbon steel Sch. 40 fittings, and designed for a working pressure of 400 psi, 70º F.
    b. Provide least one union or swivel end fitting

5. Nexus MV Manual air vents shall be of brass construction and rated at 250 psi, 450° F.
6. Shaft extensions (2" and smaller) for insulated pipe shall be at least 2¼" tall and constructed of brass
7. Provide a temperature and pressure test/meter kit (Nexus #MKA) for use by MC during start-up, turn-over to Owner at project completion.

3.06 HYDRONIC SPECIALTIES

A. Manual Air Vent: Bronze body and nonferrous internal parts; 150-psig working pressure; 225 deg F operating temperature; manually operated with screwdriver or thumbscrew; with NPS 1/8 discharge connection and NPS 1/2 inlet connection.

B. Automatic Air Vent: Spirotherm Spirotop, or equal; maintenance-free, designed to vent automatically with float principle; solid-brass body and nonferrous internal parts; 150-psig working pressure; 270°F maximum temperature; NPS 1/2 inlet connection; ½" male thread at vent point for pressure-testing or remote venting of unwanted gases. The Spirotop has a unique "dry" vent design that helps prevent the system fluid from reaching the spring actuated Viton seat and seal assembly, which is the cause of most conventional air vent failures. Air vent shall be dry: release air, not water.
   1. The unique valve mechanism is guaranteed not to leak and cannot be shut off.
   2. Specially constructed air chamber to protect the valve mechanism from dirt.
   3. Sufficient volume to handle pressure fluctuations.
   4. A reliable vacuum breaker for system draining.
   5. Leak and dirt resistant.

C. Y-Pattern Strainers: Strainers shall be Y-type with removable basket. Body shall have cast-in arrows to indicate direction of flow. Strainer screens shall have finished ends fitted to machined screen chamber surfaces to preclude bypass flow. Strainer element material shall be AISI Type 304 corrosion-resistant steel. Provide fine-mesh start-up strainers. Strainers in sizes 3-inch and smaller shall have screwed ends; Hammond 3010 or approved equal. Body material shall be cast bronze conforming to ASTM B584-C84400. Strainer bodies fitted with screwed screen retainers shall have straight threads and shall be gasketed with nonferrous metal. Strainer screens shall have perforations not to exceed 1/32". In sizes 4 and larger, strainers shall have flanged ends; Hammond 3030 or approved equal. Body material shall be cast iron conforming to ASTM A126 Class B. Strainer bodies fitted with bolted-on screen retainers shall have offset blowdown holes. Strainer screens shall have perforations not to exceed 1/16" (4" size); 1/8" (5" size and larger).

3.07 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Peterson Equipment Co., Inc.
   2. Flow Design, Inc.
   3. Trerice, H. O. Co.
   4. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
   5. Weiss Instruments, Inc.

B. Description: "Pete's Plug II", a ¼" fitting to receive either a temperature or pressure probe 1.8" OD.

C. Body: Solid brass with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping. Core Inserts: Nordel, an ethylene-propylene based synthetic rubber.

D. Minimum Pressure and Temperature Rating: 500 PSIG at 275 deg F.

3.08 WATER TREATMENT FOR CLOSED LOOP HYDRONIC SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Sentinel
2. Anderson Chemical Company.
3. Aqua-Chem, Inc.
4. Barclay Water Management, Inc.
5. General Electric Company; GE Water & Process Technologies.
6. H-O-H Water Technology, Inc.
7. Metro Group, Inc. (The); Metropolitan Refining Div.
8. Nalco; an Ecolab company.
9. Watcon, Inc.

B. Performance Requirements

1. Provide water treatment for closed-loop hydronic systems.
2. Water quality for hydronic systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of hydronic equipment without creating a hazard to operating personnel or the environment.
3. Base HVAC water treatment on quality of water available at Project site, hydronic system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.
4. Closed hydronic systems, including shall have the following water qualities:

a. pH: Maintain a value within 8.2 to 9.5.
b. "P" Alkalinity: Maintain a value within 100 to 500 ppm.
c. Total Hardness : <150 ppm as $caCO_3$.
d. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.
e. Soluble Copper: Maintain a maximum value of 0.20 ppm.
f. TSS: Maintain a maximum value of 10 ppm.
g. Ammonia: Maintain a maximum value of 20 ppm.
h. Free Caustic Alkalinity: Maintain a maximum value of 20 ppm.
i. Microbiological Limits:

1) Total Aerobic Plate Count: Maintain a maximum value of 1000 organisms/mL.
2) Total Anaerobic Plate Count: Maintain a maximum value of 100 organisms/mL.
3) Nitrate Reducers: Maintain a maximum value of 100 organisms/mL.
4) Sulfate Reducers: Maintain a maximum value of zero organisms/mL.
5) Iron Bacteria: Maintain a maximum value of zero organisms/mL.

C. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.

PART 4 - EXECUTION

4.01 HYDRONIC PIPING APPLICATIONS – ABOVE GROUND

A. Hot Water, NPS 3 and Smaller: Type L drawn-temper copper tubing with pressed or soldered joints;

4.02 VALVE APPLICATIONS

A. Hydronic Valve Applications: Shutoff Duty: Ball and butterfly valves. Throttling Duty: Globe, ball, and butterfly valves.

B. Provide shutoff duty valves at each branch connection to supply mains, at supply connection to each piece of equipment, unless only one piece of equipment is connected in the branch line.

C. Provide calibrated balancing valves in the return water line of terminal units, as indicated, and ass required to facilitate system balancing.

D. Provide pressure-reducing valves on hot-water generators and elsewhere as required to regulate system pressure.

4.03 HYDRONIC PIPING INSTALLATIONS

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. Dielectric fittings
7. Valves
8. Mechanical Identification

B. Hydronic piping systems shall be provided to permit the system to be drained. Provide drains, consisting of a tee fitting, NPS 3/4 ball valve, and hose-end fitting with cap, at low points in piping system mains and elsewhere as required for system drainage.

C. Provide piping at a uniform grade of 0.2 percent upward in direction of flow. Pipe size at connections to equipment shall be distribution main size, not connection size. Reduce pipe sizes using eccentric reducer fitting installed with level side up. Unless otherwise indicated, install branch connections to mains using tee fittings in main pipe, with the takeoff coming out the bottom of the main pipe. For up-feed risers, install the takeoff coming out the top of the main pipe.

D. Provide safety valves on hot-water generators and elsewhere as required by the ASME Boiler and Pressure Vessel Code. Provide safety-valve discharge piping, without valves, to floor. Comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, for installation requirements. Check the settings and operation of each safety valve, including valves furnished by heater manufacturer. Record settings.

E. Swing Connections for Expansion: Connect risers and branch connections to mains with at least five pipe fittings, including tee in main. Connect mains and branch connections to terminal units with flexible hoses at least four pipe fittings, including tee in main.

F. Terminal Equipment Connections
1. Size for supply and return piping connections shall be same as for equipment connections.
2. Provide control valves in accessible locations close to connected equipment.
3. Arrange piping with offsets to allow for expansion, as well as terminal unit removal.

4.04 HYDRONIC SPECIALTIES INSTALLATION

A. Provide air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

4.05 CONTROL VALVE INSTALLATION

A. Perform the following as directed by the BAS contractor:

1. Provide modulating control valves with minimum of 10 pipe diameters straight pipe at inlet and 5 pipe diameters straight pipe at outlet.
2. Installation of immersion wells and pressure tappings, along with associated shut-off cocks.
3. Installation of flow switches.
4. Setting of automatic control valves or other control devices.

B. Valve submittals shall be coordinated for type, quantity, size, and piping configuration to ensure compatibility with pipe design.

C. Slip-stem control valves shall be installed so that the stem position is not more than 60 degrees from the vertical up position. Ball type control valves shall be installed with the stem in the horizontal position.

4.06 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Provide blinds in flanged joints to isolate equipment.
5. Provide safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."

5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment to specified values.
7. Verify lubrication of motors and bearings.

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 Editon (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; ¾” 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 (2300ºF 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 0r 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: ¾".

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 ¾" 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; ½ 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: -25ºF to 180ºF; 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.

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.

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 hall be supported at manufacturer's recommended intervals, but at no greater distance than 5 feet. Maximum permissible sag is ½" 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 ¼ 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 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.

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 ft^2 of duct surface area
C_L = 4, duct leakage class, cfm per 100 ft^2 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: Trane VariTrane Single-Duct VCCF – Cooling Only or Trane VCWF – With Hot Water 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 3.85. 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. Hot Water Heating Coil:

1. The hot water coil casing shall be constructed from a minimum 20 gauge, 0.032 inch galvanized steel, factory-installed on the terminal discharge with slip-and drive attachment for downstream ductwork.
    a. An optional gasketed access door shall be provided, located on bottom of unit.
    b. Coil handing shall be specified as [right hand] or [left hand] when looking into the coil inlet in the direction of airflow.
    c. The water coil shall be supplied with an access door located:
        1) Upstream of the water coil in the terminal casing.
        2) Downstream of the water coil in a common casing with the coil.
    d. The water coil access door shall be secured to the casing with (**select one**):
        1) Screws.
        2) Snap latches.
        3) Quarter turn sash latches.
2. The water coil fins shall be 0.0045 inch aluminum fins, mechanically-bonded to seamless 0.50 by 0.016 inch copper tubes.
    a. Fins shall be sine wave configuration.
    b. Standard coil shall be a 10 fins-per-inch fin construction.
    c. High capacity coil shall be a12 fins-per-inch fin construction.
3. All water coils shall be hydrostatically tested to a minimum 390 pounds per square inch, with a minimum burst pressure of 1800 pounds per square inch at ambient temperature. All water coils are rated for a maximum of 300 pounds per square inch working pressure at 200 degrees Fahrenheit.
4. The water coil shall be certified in accordance with AHRI 410 and units shall bear an AHRI 410 label.
    a. An optional oversized casing shall be upsized to increase heat transfer with low supply water temperatures while reducing air side pressure drop.

G. 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.

H. 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.

I. 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.

J. 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. ½ 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 ¾" 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.

C. Linear Slot Ceiling Diffusers

1. Material: steel (Price Model SDB)
2. Diffusers shall have discharge slots (quantity and widths as scheduled) with extruded aluminum aerodynamically curved "ice-tong" shaped pattern controllers for 180 degree air pattern control and airflow dampering if required.
3. The diffuser border shall be heavy extruded aluminum construction with extruded aluminum spacers and (mitered end flanges, open ends, flush end caps or angle end caps). Continuous length units shall be provided with factory assembled corner modules to suit drawings and on site conditions. Joiner strips shall be provided to align continuous slot assemblies.
4. Diffuser shall be provided with insulated plenums. Plenums shall be constructed of zinc coated steel and have 1/4" internal insulation. Plenum assembly shall have sloped shoulders for enhanced spread characteristics. Plenum assemblies shall be of a side inlet configuration.

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 33

DEDICATED OUTDOOR-AIR UNITS

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

1.02 SUMMARY

A. Section includes factory-packaged dedicated outside air systems (DOAS).

1.03 ACTION SUBMITTALS

A. Product Data: For each dedicated outdoor-air unit.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
3. Include unit dimensions and weight.
4. Include cabinet material, metal thickness, finishes, insulation, and accessories.
5. Fans:

    a. Certified fan-performance curves with system operating conditions indicated.
    b. Certified fan-sound power ratings.
    c. Fan construction and accessories.
    d. 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 heat exchangers with performance characteristics.
9. Include dampers, including housings, linkages, and operators.
10. 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 dedicated outdoor-air units to include in emergency, operation, and maintenance manuals.

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. Filters: One set for each unit.

1.06 SOURCE QUALITY CONTROL

A. AHRI 920: Manufacturer to certify that performance ratings are in accordance with AHRI 920 if AHRI 920 certification program is not in place. Provide AHRI 920 certification if AHRI 920 certification program is in place.

B. AHRI 260 or AMCA 311 Sound Performance Rating Certification: Test, rate, and label unit fan sound ratings in accordance with AHRI 260 or AMCA 311.

C. Fan Aerodynamic Performance Rating: Test and rate fan performance for airflow, pressure, power, air density, rotation speed, and efficiency.

1. Fan Aerodynamic Performance Rating: Test and rate fan performance in accordance with AMCA 210.
2. AMCA Fan Aerodynamic Certification Rating: Test, rate, and label, in accordance with AMCA 211.

D. Fan Energy Index (FEI): Test in accordance with AMCA 210 and rate in accordance with AMCA 99, AMCA 207, and AMCA 208.

E. Fan Operating Limits: Classify fans in accordance with AMCA 99, Section 14.

F. Damper Leakage and Air Performance:

1. Damper Rating: Test and rate dampers for leakage and air performance in accordance with AMCA 510.
2. AMCA Damper Certification: Test, rate, and label in accordance with AMCA 511.

G. Water Coils: Factory tested to 300 psig in accordance with AHRI 410 and ASHRAE 33.

H. Refrigerant Coils: Factory tested to minimum [**300 psig**] [**450 psig**] internal pressure and to minimum 300 psig internal pressure while under water, in accordance with AHRI 410 and ASHRAE 33.

1.07 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an "NRTL" (nationally recognized testing laboratory) and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of units and components.

C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE 15 and ASHRAE 34 Compliance: For refrigeration system safety.

E. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

F. ASHRAE 84 Compliance: Comply with capacity ratings for energy-recovery equipment.

1.08 WARRANTY

A. Warranty: Manufacturer agrees to replace components of dedicated outdoor-air units that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Dedicated Outdoor-Air-Handling Units: One year for entire unit, based on 12 months from startup or 18 months from shipment (whichever is sooner)
2. Warranty Period for Compressors: Five-year parts
3. Warranty Period for Gas Heat Exchangers: 10 years from date of startup or shipment depending on start date relative to ship date.
4. Warranty Period for Rotary Heat Exchangers: 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. Addison (Basis of Design)
2. Aaon
3. Daikin

2.02 DOAS UNIT

A. General: The unit shall be a packaged factory assembled heating and/or cooling system. The unit shall include all factory wiring with a single point power connection, phase and voltage monitor, refrigerant piping and charge (R-454B), operating oil charge. Single refrigerant circuit (sizes 036–096) or dual refrigerant circuits (sizes 120–840), shall include a microprocessor based control system. The unit shall, based on project requirements, include all special features necessary to provide fully conditioned ventilation air to the building.

1. Units are designed for low ambient heat pump operation utilizing control sequences and internal components to have active prevention of traditional defrost mode where cold air is introduced to the space (i.e. reverse cycle / cooling mode). See condenser coil spec for further details.

B. Unit Cabinet: 4 Condenser Fans w/ Copper Tube / Aluminum Fin Condenser Coils.

1. Cabinet is double wall design with heavy-duty frame and reinforced base. Double wall panels are constructed of G-90 galvanized steel inside and out with a polyester exterior finish for up to 2,500 hour salt-spray protection. Fixed panels on sides and top have two-

inch thick, closed cell foam insulation; access panels have two-inch foam injection insulation provides an R-13 rating to reduce heat transfer losses. Access panels are fitted with one-quarter turn self-tightening latches (one lockable) and stainless steel hinges. Top panels are raised to improve water run-off and include drip edge. Heavy Duty 16-guage base pan has 0.375 inch closed cell insulation on the underside to serve as sound attenuation and as a moisture/thermal barrier and a positive seal to the curb. Bottom openings include a minimum one-half inch turned up flange. Stainless steel and/or MAGNI® 555-coated hardware reduce fastener corrosion. Efficient micro-channel condenser coils are standard (heat-pumps have fin and tube). The condenser section on units with four or more fans has removable channels for proper roof clearance. A double-sloped, extra-large, stainless steel drain pan equipped with drain fitting positioned on exterior of cabinet to facilitate removal of condensate and eliminate standing water.

C. Fans:

1. Indoor Supply, Return/Exhaust Fans:

a. Direct-drive plenum fan(s) shall be provided and both axial and radial clearances must be equal to or greater than fan manufacturer's recommendations for full rated fan performance and efficiency. The inlet cone, impeller with backward curved or airfoil blades is manufactured of steel with a painted finish. Fan assembly shall be statically and dynamically balanced at the factory as a single rotating assembly to a quality level of G=2.5 in accordance with DIN ISO 1940-1. Provide ODP or TEFC premium efficiency motors with VFD. Fan motor assembly is rigid mounted for optimal performance.

b. Provide the following options:

1) 1-inch spring isolation mount
2) Airflow monitoring wired back to factory controller

c. ECM type assembly is base mounted and external rotor fan with backward curved blades of high performance composite material. Fan assembly shall be statically and dynamically balanced at the factory as a single rotating assembly to a quality level of G=6.3 in accordance with DIN ISO 1940-1. ECM fans shall have airflow monitoring included

2. Condenser Fan and motor fully assembled by manufacturer:

a. Fans shall be external rotor direct driven axial fans with a minimum 5-1/2" powder coated spun venturi for high efficiency and low noise, with powder coated sickle shaped blades.
b. The fan motor TEAO, totally enclosed air over, assembly shall be end mounted to a structurally powder coated rigid welded finger guard.
c. Fans shall be VFD driven for controlling head pressure. Low ambient operation is 0°F.
d. Fans shall discharge air vertically upward and the finger guard shall be powder coated.
e. Fans shall be statically and dynamically balanced as an assembly to a quality level of G=6.3 in accordance with DIN ISO 1940-1.

D. Compressors:

1. Fully hermetic, scroll type compressors with overload protection and short cycle protection with minimum on and off timers. Time delay relay 5 minute minimum ON run time for proper oil level and compressor operation
2. Compressor shall be installed in an insulated compartment accessible through hinged access doors for sound mitigation. Exposed compressors must be applied with sound blankets for sound mitigation.
3. Line voltage, low voltage operating controls, refrigerant circuit access points, refrigerant flow control devices and compressors shall be accessible from a single location behind stainless steel piano hinged access doors for ease of service.
4. Compressors shall be mounted on rubber in shear isolators and refrigerant lines to include reaction torque loops.
5. Reverse rotation protection shall be provided for all compressors and all 3 phase motors in the unit.
6. Crankcase heaters shall only be activated during compressor off mode.
7. Provide the following options: Variable Capacity Compressor(s):

    a. On circuits up to eight (8) tons a digital compressor shall be available on the lead refrigeration circuit. The control system shall be capable of unloading the compressor in an unlimited number of steps for capacity control. For units without ALC DDC controllers a Digital Control Module (DCM) shall be included.
    b. On circuits from ten (10) tons and larger a variable capacity compressor with a variable speed drive shall be available on the lead refrigeration circuit. The control system shall be capable of unloading the compressor in an unlimited number of steps for capacity control. Unit sizes 480 and larger have tandem type compressors. The lead compressor shall include a variable speed drive and staging control for remaining compressors for capacity control.

E. Refrigerant Components:

1. Unit shall be equipped with single refrigerant circuit (sizes 036–096) or dual refrigerant circuits (sizes 120 and up) with each circuit containing:
    a. Solid core filter drier.
    b. Field adjustable externally equalized thermostatic expansion valve.
    c. Service access ports

2. Unit shall be equipped with VFD-controlled variable condenser fan speed operation for head pressure control to allow low ambient operation down to 0°F.
    a. Unit shall be equipped with VFD-controlled variable condenser fan speed operation fhead pressure control to allow low ambient operation down to 0°F.

3. Refrigeration Controls/Options : Electronic Hot Gas Bypass FrostShield
    a. Refrigeration Controls/Options, Hot Gas Bypass with Electronic valve.
    b. Hot Gas Reheat, Modulating (Single Circuit)
        1) Refrigeration Controls/Options, Hot Gas Reheat, Modulating with Variable Speed Head Pressure Control (Single Circuit), Includes one-row coil and Electronic valve.

F. Coils:

1. Standard evaporator coil shall have enhanced surface aluminum sine wave fins mechanically bonded to seamless copper tubes.
2. Evaporator coils shall be minimum six (6) row with intertwined circuiting. Stacked coils shall be intertwined circuiting for the full face area to be active and prevent any stratified air temperatures from occurring.

3. Air Cooled Condensing Coil, Cooling only duty: microchannel floating microchannel condenser coil mounting design with rubber isolation and glide path for coil expansion and contraction. Rigid mounted microchannel condenser coils are not acceptable.

    a. Air Source Heat Pump duty: Standard air-over condenser coils shall have enhanced
    b. surface aluminum plate fins mechanically bonded to seamless internally grooved copper tubes with brazed tube joints.
    c. Air source Heat Pump shall be proactively controlled for frost free heat pump duty. Factory installed sensors, controls, and refrigerant valve(s) shall allow heat pump duty to an ambient of -4 deg F without defrost operation.

        1) Heat pumps shall not rely on timed or cycled defrost control due to increased energy consumption for owner
        2) Units requiring a defrost sequence of operations shall not introduce cold air into the space. Units requiring defrost shall energize supplemental heat in compliance with the project electrical requirements. Units are not to exceed scheduled MCA / MOCP. Units exceeding the MCA/MOCP will be the responsibility of the installing mechanical contractor

G. Coil Options Provided:

1. A factory-installed hot gas reheat (HGRH) coil shall be available. The HGRH coil shall be an available option on the lead circuit only or with a dual circuit coil for reheat both refrigerant circuits. Precise leaving DX coil air temperature sensor and control prior to reheat coil, for verification of proper de-humidification operation, as well as ease of troubleshooting and diagnostics. Saturated Suction Temperature control is inadequate and not acceptable.

H. Filter Section:

1. Standard filter section shall have filter racks for 2-in. thick MERV-8 pleated media filters as standard.
2. Provide the following options:

    a. Filter section shall be supplied with 2” MERV-8 pre-filter plus 4” MERV 13 type filters.
    b. 2” Metal Mesh Hood Mounted Filters shall also be included
    c. Dirty Filter Status Switch: shall be a pressure differential switch and will indicate a dirty filter. The switch shall be factory installed.
    d. Magnahelic filter gauge shall also be factory provided and installed

I. Commissioning User Interface: The commissioning HMI shall be a color touchscreen with access to all available modes, applicable setpoints and statuses, unit networking information and the like.

1. Interface:

    a. Safeties:

        1) Compressor lockout protection provided for either internal or external overload.
        2) Low-pressure protection.
        3) Freeze protection (evaporator coil).
        4) High-pressure protection.
        5) Loss of charge protection.

b. Supply-air sensor shall be located in the unit and shall be used for compressor stage control.
c. Unit shall be equipped with a supply fan status switch to protect the system in the event of a fan drive failure.
d. Induced draft heating section shall be provided with the following minimum protections:

1) High-temperature limit switch.
2) Differential pressure switch for proof of induced draft.
3) Flame rollout switch.
4) Flame proving controls.
5) Redundant style gas valve.

J. Operating Characteristics:

1. Unit shall be capable of operating upwards of 115° F. outdoor ambient air temperature per maximum load criteria of AHRI Standard 920 and AHRI Standard 340/360.
2. Unit with standard controls will operate in cooling down to an outdoor ambient temperature of 0 ° F.
3. Units shall be equipped with an enthalpy control economizer with modulating outdoor and return air dampers.
4. Unit shall be provided with fan time delay to prevent cold air delivery (gas heat only).

K. Electrical Requirements:

1. Control panel shall incorporate “Touch-safe” design.
2. Phase/Voltage Monitor: A factory-installed over / under-voltage and phase loss sensor shall stop the unit whenever voltage exceeds allowable range, phases are out of sequence, or a phase is dropped. The unit will restart automatically within five minutes after the correct power is supplied. Display shall be capable of archiving and display of last four (4) faults modes.
3. Provide dual point power.
4. Convenience Outlet: Shall be factory-installed and internally mounted with an externally accessible 115-v, 15 amp GFCI, female receptacle with hinged cover. Factory-wired GFI with a step-down transformer and 15.0 Amp breaker.
5. Firestat: A factory-installed, manual-reset firestat shall be mounted in the return air opening of the unit. The firestat shall be set to open at 135 F.
6. Unit panel shall carry 65 KA SCCR rating. Unit sub wiring including contactors and motor starter protector rated at a minimum of 65KA. Over current protection devices for VFD's and ECM blowers are upgraded to fuses per manufacturers specs to increase the rating to a minimum of 65k.

L. Motors:

1. Compressor motors shall be cooled by refrigerant gas passing through motor windings and shall have either internal line break thermal and current overload protection or external current overload modules with compressor temperature sensors.
2. All condenser fan motors shall be totally enclosed air-over (IP54) with permanently lubricated ball bearings, class F insulation and manual reset overload protection.
3. Standard indoor fan motors shall be open drip proof design. Optional totally enclosed fan-cooled motors are available.

M. Sequence of Operation:

1. DOAS-1 Sequence of Operation:
   a. Provide factory VAV sequence of operation.
   b. Provide night setback mode and include NSB Damper

N. Unit Accessories and Options:

1. Energy Recovery:
   a. Wheel Media: The SEW, or sensible energy recovery wheel, shall be constructed of corrugated synthetic fibrous media without the inclusion of a desiccant. Media shall be synthetic to provide corrosion resistance and resistance against attack from laboratory chemicals present in pharmaceutical, hospital, etc. environments as well as attack from external outdoor air conditions. Coated aluminum is not acceptable. Face flatness of the wheel shall be maximized (+/- 0.032 in) to minimize wear on inner seal surfaces and to minimize cross leakage. Rotor shall be constructed of alternating layers of flat and corrugated media. Wheel layers should be uniform in construction forming uniform aperture sizes for air flow. Wheel construction shall be fluted or formed honeycomb geometry to eliminate internal wheel bypass. Wheel layers that can be separated or spread apart by air flow are unacceptable due to the possibility of channeling and performance degradation. The minimum acceptable performance shall be as specified in the drawings/submittal.
   b. Wheel Media Support System: The wheel frames shall consist of evenly spaced steel spokes, galvanized steel outer band and rigid center hub. The wheel construction should allow for post fabrication wheel alignment.
   c. Wheel Seals: The wheel seals shall be a contact brush seal on both the periphery of the wheel and the face. Seals should be easily adjustable.
   d. Wheel Cassette: Cassettes shall be fabricated of heavy duty reinforced galvanized steel or welded structural box tubing. Cassettes shall have a built-in adjustable purge section minimizing cross contamination of supply air. Bearings shall be inboard, zero maintenance, permanently sealed roller bearings, or alternatively, external flanged bearings or pillow block. Drive systems shall consist of fractional horsepower A.C. drive motors with multilink drive belts.
   e. Energy Recovery Options, VFD defrost, wheel speed is slowed as frost condition occurs plus wheel bypass; includes two position dampers in outside and return air streams.

2. Gas Heating:

   a. Gas heat shall be induced-draft combustion type with energy saving direct spark ignition systems and redundant main gas valves.
   b. The heat exchanger shall be of the tubular section type constructed of a minimum of 20-gauge type 409 stainless steel.
   c. Burners shall be of the in-shot type constructed of aluminum coated steel.
   d. All gas piping shall be clearly identified on the unit cabinet.
   e. Induced-Draft Fans:

      1) Shall be direct-driven, single inlet, forward- curved centrifugal type.
      2) Shall be statically and dynamically balanced.
      3) Shall be made from steel with a corrosion- resistant finish.

   f. High-corrosion areas such as flue gas collection and exhaust areas shall be lined with corrosion resistant material.
   g. The unit shall have factory-installed gas heat with modulation options:

      1) Modulating control providing 20% to 100% burner modulation

h. Furnace shall be accessed by a tool type latched and hinged service door as required by ANSI.
i. Heat exchanger is warranted for ten (10) years on a pro-rated basis.

3. Full Perimeter Roof Curb (unless stated otherwise on schedule):

a. 30” high flat insulated curb shall be formed of minimum 16-gage galvanized steel with wood nailer strip and shall be capable of supporting entire unit weight. Curbships knocked down and requires field assembly provided “by others”.

4. Dampers: Outside Air Damper, and Return Air Damper:

a. Factory mounted AMCA certified, low leakage airfoil control dampers. Frame shall be one-piece uniframe construction of 16 ga. (1.6) galvanized steel roll formed hat channel structurally equivalent to a minimum 13 ga. (2.4) frame. Blades shall be 14 ga. (2.0) equivalent galvanized steel, roll-formed airfoil type for low pressure drop and low noise generation.
b. Bearings shall be 304 stainless steel, oil impregnated, and self-lubricating sleeve type with a 450 pound (204 kg) minimum radial crush load. Damper shall be tested and licensed in accordance with AMCA 511 for Air Performance and Air Leakage. Damper widths from 12" to 60" (305 to 1524) wide shall not leak any greater than 3 cfm/sq.ft. at 1" w.g. (15.2 l/s-m2 at .25 kPa).

5. Dampers: Exhaust Air Damper:

a. Standards: Frame shall be 20-gauge (1.0) roll-formed galvanized steel. Blades shall be 28-gauge (.50) roll-formed galvanized steel. Backdraft dampers shall be designed for maximum 3,000 fpm face velocities.

2.03 UNIT CONTROLS

A. Control panel / connections: Units shall have an electrical control center where all high and low voltage connections are made. The control center shall be constructed to permit single-point high voltage power supply connections.

B. Unit shall be provided with a unit disconnect switch.

C. Packaged DX Control and Diagnostics: The Packaged DX system shall be controlled by an onboard digital controller (DDC) that indicates both owner-supplied settings and fault conditions that may occur. The DDC shall be programmed to indicate the following faults:

1. Global alarm condition (active when there is at least one alarm)
2. Supply Air Proving alarm.
3. Compressor Trip alarm
4. Compressor Locked Out alarm.
5. Supply Air Temperature Low Limit alarm

a. Sensor #1 Out of Range (outside air temperature)
b. Sensor #2 Out of Range (supply air temperature)
c. Sensor #3 Out of Range (cold coil leaving air temperature)

D. Motorized dampers / Intake Air, Motorized dampers of low leakage type shall be factory installed.

E. Unit Control

1. The unit shall be constructed so that it can function as a stand-alone heating and cooling system controlled by factory-supplied controllers, thermostats and sensors or it can be operated as a heating and cooling system controlled by a Building Automation System (BAS). This unit shall be controlled by a factory-installed microprocessor programmable controller (DDC) that is connected to various optional sensors.
2. Unit shall incorporate a DDC controller with integral LCD screen that provides text readouts of status. DDC controller shall have a built-in keypad to permit operator to access read-out screens without the use of ancillary equipment, devices or software. DDC controllers that require the use of equipment or software that is not factory-installed in the unit are not acceptable. Alarm readouts consisting of flashing light codes are not acceptable. Owner-specified ventilating conditions can be input by means of pushbuttons.
3. Dirty filter sensor shall be factory installed.
4. Provide an energy wheel rotation sensor.
5. Outside Air / Return Air damper control shall be factory installed.
6. Economizer control shall be temperature / enthalpy.
7. Operating protocol: The DDC shall be factory-programmed for BACnet MSTP or IP (coordinate with controls contractor).
8. Variable Frequency Drive (VFD): unit shall have factory installed variable frequency drive for modulation of the supply and exhaust air blower assemblies. The VFD shall be factory-programmed for unit-specific requirements and shall not require additional field programming to operate.

F. The controller shall be provided with the required sensors and programming for the rooftop unit. Controller shall be factory programmed, mounted, and tested. The controller shall have an LCD readout for changing set points and monitoring unit operation.

1. Unit Start Command:

    a. Factory mounted and wired outdoor air damper actuator is powered.
    b. Damper End Switches: Damper end switches shall be provided to ensure the supply and exhaust fans do not enable until the dampers are proven open.
    c. Exhaust fan starts after a (adj.) delay.
    d. Supply fan starts after a (adj.) delay.
    e. Tempering options and energy wheel option to function as described below.

2. Unit Stop Command (or De-Energized):

    a. Supply fan, exhaust fan, energy wheel and tempering options de-energized.
    b. The outdoor air damper actuator is spring return close.

3. Occupied/Unoccupied Modes: Shall be based on a 7-day time clock internal to the controller. The schedule shall be set by the end user. When a user initiates an override input, the controller will switch from unoccupied to occupied mode. The controller will return to the scheduled occupied/unoccupied mode after the override time has expired. If internal time clock is disabled, a remote contact or a BAS can control the occupied/unoccupied mode.
4. Occupied Mode:

    a. Damper control per below.
    b. Energy wheel control per below.
    c. Exhaust fan ON.
    d. Supply fan ON.
    e. Heating per below.
    f. Cooling per below.

5. Unoccupied Mode (Unit Off): Unit remains off when in unoccupied mode.

    a. Supply fan OFF
    b. Exhaust fan OFF
    c. Tempering OFF
    d. Outdoor air damper closed.

6. Morning Warmup/Cool Down: Prior to occupancy, the unit will run using the warmup or cool down sequence until the occupied set point is achieved. The heating or cooling mode must not be locked out and the space temperature is below or above set point by the unoccupied hysteresis (adj.).
7. Supply Blower Sequence: A VFD shall be provided and installed at the factory, pre-set to control the speed of the blower motor for optimum performance. The motor speed needs to be verified during test and balance of the unit. Configured for Constant Air Volume (CAV), the VFD will operate in an ON/OFF fashion and the speed of the motor will not change.
8. Exhaust Blower Sequence: A VFD shall be provided and installed at the factory, the microprocessor shall proportionally modulate the exhaust fan based upon the supply fan.
9. Outdoor Air Damper Control: The outdoor air damper shall be factory mounted and wired with a non-modulating actuator. When the unit is enabled/occupied the outdoor air damper will open to 100%
10. Cooling Sequence: The cooling is controlled to maintain the supply temperature set point. The mechanical cooling will be locked out when the outside air is < 55°F (adj.).
11. Packaged DX Cooling (Inverter Scroll): The controller will provide a modulating signal for cooling. From 0-100%, the inverter scroll will be controlled to maintain discharge temperature. The electronic expansion valve will modulate to maintain 8.0 F of superheat. The controller will provide a modulating signal for cooling. From 0-50%, the inverter scroll will be controlled to maintain discharge temperature. From 50-100% the second stage will be on in combination with the inverter scroll compressor to maintain the discharge temperature. The electronic expansion valve will modulate to maintain 8.0 F of superheat.

    a. Modulating Hot Gas Reheat Sequence: During dehumidification the modulating HGRH is controlled to maintain the supply temperature set point.
    b. Modulating Head Pressure Control: Lead condenser fan will have an EC motor and will modulate to maintain a head pressure set point.

12. Dehumidification Control Sequence: The cooling is controlled to maintain the cooling-coil set point. The dehumidification sequence will be locked out when the OA is < 10 F(adj.) above the cold coil set point (adj.). Cold Coil Set Point Control: The controller will control the cooling to maintain a cold coil set point. The active set point will be set to local control (55 F, adj.) from the factory and can be field adjusted locally or by the BAS.

13. Provide a factory-mounted condensate overflow switch. In the event that a high level of condensate is detected, the microprocessor controller will trigger an alarm and shutdown the unit.

14. Heating Sequence: The heating is controlled to maintain the supply temperature set point. The heating will be locked out when the outside air is > 80°F (adj.). The maximum allowable discharge air set point is 100°F.

    a. Indirect Gas Furnace: The controller will modulate the indirect gas furnace to maintain the supply temperature set point (adj.).
    b. Building Freeze Protection: If the supply air temperature drops below 35 F (adj.) for 300 seconds (adj.), the controller will de-energize the unit and activate the alarm output.

c. Temperature Protection: The controller will enable the supply fan to modulate down to help the unit keep up with heating demand in the event of wheel failure or the unit operating outside design conditions.

15. Economizer Sequence: When the application requires cooling, and the outdoor air conditions are suitable for free cooling, the controller will modulate the energy wheel speed to maintain the discharge temperature set point. If the energy wheel speed modulates to the economizer set point and the supply air temperature is not met, the controller will increase the call for cooling to meet the supply air temperature and could engage mechanical cooling.

    a. Temp./Enthalpy: The economizer will be locked out when: the outdoor air is < 40 F DB (adj.) or > 75 F DB (adj.) or > 55 F dew point (adj.) ; the unit is operating in dehumidification mode; or there is a call for heating.
    b. When economizer mode is enabled and there is a signal for cooling, the wheel VFD modulates wheel speed to maintain the supply air temperature set point.

16. Alarms Indication: The controller will display alarms and have one digital output for remote indication of an alarm condition.

G. BAS Interfacing: A BAS port or serial card is provided with the controller for field interfacing with a building management system. Each card is sent out with the default parameters, and the controls contractor must change the appropriate addresses to match the BAS settings.

H. Phase and brownout protection: Unit shall have a factory-installed phase monitor to detect electric supply phase loss and voltage brown-out conditions. Upon detection of a fault, the monitor shall disconnect supply voltage to all motors.

I. Duct smoke detector shall be factory installed in the return air plenum to shut down the unit. The air duct smoke detector housing shall be UL listed per UL 268A. The detector shall consist of an alarm initiation contact and two DPDT auxiliary contact closures.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine 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 piping, ducts, and electrical systems to verify actual locations of connections before equipment installation.

C. Examine roof curbs and equipment supports for suitable conditions where units will be installed.

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

3.02 INSTALLATION, GENERAL

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. Roof Curb: Provide on roof structure, level and secure, in accordance with NRCA's "The NRCA Roofing Manual: Membrane Roof Systems". Provide units on curbs and coordinate roof

penetrations and flashing with roof construction with Division 7. Secure units to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts. Coordinate sizes and locations of roof curbs with actual equipment provided.

C. Provide filter-gauge, static-pressure taps upstream and downstream of filters. Mount filter gauges on outside of filter housing or filter plenum in accessible position. Provide filter gauges on filter banks, installed with separate static-pressure taps upstream and downstream of filters.

D. Provide separate devices furnished by manufacturer and not factory installed.

E. Provide new filters at completion of equipment installation and before testing, adjusting, and balancing.

3.03 PIPING CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to units, allow space for service and maintenance.

C. Connect piping to units mounted on vibration isolators with flexible connectors.

D. Gas Piping: Comply with requirements in Section 22 11 23 "Facility Fuel Gas Piping." Comply with requirements for gas-fired furnace installation in NFPA 54 and Maine Fuel Gas Code.

1. Connect gas piping to furnace, full size of gas train inlet, and connect with union, pressure regulator, and shutoff valve with sufficient clearance for burner removal and service.
2. Provide AGA-approved flexible connectors.

E. Duct Connections:

1. Comply with requirements in Section 23 31 13 "Ductwork"
2. Drawings indicate the general arrangement of ducts.
3. Connect ducts to units with flexible duct connectors. All air systems, supply and return.

3.04 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Division 26.

B. Ground equipment in accordance with Division 26.

C. Provide electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

D. Provide nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

E. Provide control and electrical power wiring to field-mounted control devices. Connect control wiring in accordance Division 26.

3.05 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup-checks in accordance with manufacturer's written instructions.
2. Units with Gas Furnaces:

    a. Inspect units for visible damage to furnace combustion chamber.
    b. Perform the following operations for both minimum and maximum firing, and adjust burner for peak efficiency:

        1) Measure gas pressure at manifold.
        2) Measure combustion-air temperature at inlet to combustion chamber.
        3) Measure flue-gas temperature at furnace discharge.
        4) Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
        5) Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.

    c. Clean furnace flue and inspect for construction debris.
    d. Inspect operation of power vents.
    e. Purge gas line.
    f. Verify operation of remote panel, including pilot-light operation and failure modes. Inspect high-limit heat exchanger and alarms.

3. Inspect units for visible damage to refrigerant compressor, condenser and evaporator coils, and fans.
4. Start refrigeration system when outdoor-air temperature is within normal operating limits. and measure and record the following:

    a. Cooling coil leaving-air, dry- and wet-bulb temperatures.
    b. Cooling coil entering-air, dry- and wet-bulb temperatures.
    c. Condenser coil entering-air dry-bulb temperature.
    d. Condenser coil leaving-air dry-bulb temperature.

5. 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 outdoor-air intake.

6. Inspect casing insulation for integrity, moisture content, and adhesion.
7. Verify that clearances have been provided for servicing.
8. Verify that controls are connected and operable.
9. Verify that filters are installed.
10. Clean coils and inspect for construction debris.
11. Inspect and adjust vibration isolators.
12. Verify bearing lubrication.
13. Clean fans and inspect fan-wheel rotation for movement in correct direction without vibration and binding.
14. Start unit.
15. Inspect and record performance of interlocks and protective devices, including response to smoke detectors by fan controls and fire alarm.
16. Operate unit for run-in period.
17. Calibrate controls.

18. Adjust and inspect high-temperature limits.
19. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
20. Verify operational sequence of controls.
21. Measure and record the following airflows. Plot fan volumes on fan curve.

    a. Supply-air volume.
    b. Relief-air flow.
    c. Outdoor-air flow.

B. After startup, change filters, verify bearing lubrication, and adjust belt tension.

C. Remove and replace components that do not properly operate and repeat startup procedures as specified above.

D. Prepare written report of the results of startup services.

3.06 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 from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.07 FIELD QUALITY CONTROL

A. Cleaning:

1. Comply with Section 23 31 13 “Ductwork” Paragraph: Field Quality Control.
2. After completing system installation; testing, adjusting, and balancing unit and air-distribution systems; and completing startup service, clean units internally to remove foreign material and construction dirt and dust. Clean fan wheels, casings, dampers, coils, and filter housings, and install new, clean filters.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Leak Test: After installation, fill coils with water, and test coils and connections for leaks.
2. Charge refrigerant coils with refrigerant and test for leaks.
3. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Testing of Drain Pans. To minimize conditions of water stagnation that may result in microbial growth, inspect drain pans to verify proper drainage under operating conditions.

3.08 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

SECTION 23 82 30

ELECTRIC UNIT HEATERS

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. This Section includes heaters with propeller fans and electric heating elements.

1.03 SUBMITTALS

A. Product Data: Include rated capacities, dimensions, operating characteristics, furnished specialties, and accessories. Provide wiring diagrams showing power, signal, and control wiring.

B. Operation and Maintenance Data: For heaters to include in emergency, operation, and maintenance manuals.

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. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.01 ELECTRIC WALL HEATERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. Berko Electric Heating
   2. Chromalox, Inc
   3. Indeeco.
   4. Markel Products
   5. QMark Electric Heating
   6. Trane.

B. Description: An assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.

C. Cabinet:

1. Front Panel: Extruded-aluminum bar grille, with removable panels fastened with tamperproof fasteners.
2. Finish: Baked enamel over baked-on primer with manufacturer's standard color selected by Architect, applied to factory-assembled and -tested wall and ceiling heaters before shipping.

D. Surface-Mounting Cabinet Enclosure: Steel with finish to match cabinet.

E. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high temperature protection. Provide integral circuit breaker for overcurrent protection.

F. Provide surface mounting or recessed mounting hardware. See drawings.

G. Fan: Aluminum propeller directly connected to motor.

H. Motor: Permanently lubricated.

I. Controls: Provide a 24V Control Relay for BAS control.

J. Electrical Connection: Factory wire motors and controls for a single field connection with disconnect switch.

K. Provide a factory disconnect switch.

2.02 CABINET UNIT HEATERS

A. Basis of Design: Indeeco 922.

B. Enclosures shall be 20-gauge (.035” min.) galvanneal steel enclosure, deep drawn to add rigidity. Enclosure designed to withstand heavy-duty commercial and institutional use.

C. Enclosures shall be chemically treated to resist corrosion and then finished in baked enamel powder coating. Finish shall be mar and temperature resistant. Color to be White.

D. Wiring compartment to be located at the right side of the heater with a hinged door to allow full access to wiring and controls. Enclosure to include knockouts for wiring and locations for optional accessories.

E. Enclosure to include removable grilles so that the orientation of the inlet and outlet air can be changed on site.

F. Enclosure designed to allow for horizontal or vertical installation.

G. Heaters shall be designed with advanced pull through airflow to allow air to be pulled across the elements for cooler element operation.

H. Motor shall be direct drive, permanently lubricated, totally enclosed.

I. Heating elements shall be constructed with nickel chromium wire encased in a steel sheath or stainless steel sheath, and MgO material. Aluminum fins are to be designed for a chimney effect to maximize airflow and pressure bonded to the steel sheath for efficient heat transfer. Elements shall be U-shaped to maximize heat transfer.

J. Heater shall include an automatic reset thermal overheat protector that shall run the full-length of the heater and shall turn off heating elements should overheating occur at any point along heating length. Automatic reset overheat protector shall restore operation automatically when cause of overheating is removed.

K. Built-in controls shall be capable of installing in the standard unit enclosure with no separate control box needed. Built-in single-pole, single-stage thermostat that cycles the elements and fan. Fan speed and element wattage selected by the built-in HIGH or LOW selector switch.

L. Provide a three-pole non-fused disconnect switch to disconnect power to the heater. Design prevents entry into the control compartment until disconnect switch is turned to the OFF position.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive heaters for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for electrical connections to verify actual locations before heater installation.

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

3.02 INSTALLATION

A. Provide per manufacturers instructions.

B. Provide heaters to comply with NFPA 90A.

C. Ground equipment and connect wiring according to Division 26 requirements.

3.03 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Operate electric heating elements to verify proper operation and electrical connections.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning units and retest as specified above.

3.04 ADJUSTING

A. Adjust initial temperature set points.

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.

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 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 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.

2.02 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.

2.03 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.

2.04 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 Crawlspaces: 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 Crawlspaces: 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 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.

2.02 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.

2.03 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.

2.04 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.

2.05 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 reequirements.

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 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.

2.02 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 slottedsupport 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 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.

2.02 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.

2.03 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.

2.04 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.

2.05 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.

2.06 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: ¾ 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 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 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).

2.02 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. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating or Stainless steel of length required to secure pressure plates to sealing elements.

2.03 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.

2.04 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.

2.05 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.

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 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.

2.02 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,.

2.03 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."

2.04 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.

2.05 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).

2.06 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.

2.07 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 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 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.

2.02 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.

2.03 Wall stations: Provide wall station lighting controls (symbols SE4 and SE2) as indicated on plans and lighting control details

2.04 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.

2.05 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 thanNo. 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 24 16

PANELBOARDS

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. Distribution panelboards.
   2. Lighting and appliance branch-circuit panelboards.

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

1.03 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. TVSS: Transient voltage surge suppressor.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

   1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.

2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
6. Include wiring diagrams for power, signal, and control wiring.
7. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

C. Delegated Design Submittal:

1. For arc-flash hazard, short-circuit and coordination analysis and report.
2. For arc-flash labels.

1.05 INFORMATIONAL SUBMITTALS

A. 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.

B. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01, include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

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. Keys: Two spares for each type of panelboard cabinet lock.

1.08 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards 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 1.

E. Comply with NFPA 70.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards.

B. Handle and prepare panelboards for installation according to NECA 407.

1.10 PROJECT CONDITIONS

A. Environmental Limitations:

1. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

   a. Ambient Temperature: Not exceeding minus 22 deg F to plus 104 deg F.
   b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

C. 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. Do not proceed with interruption of electric service without Owner's written permission.
3. Comply with NFPA 70E.

1.11 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, 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.

1.12 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

B. Enclosures: Flush- and surface-mounted cabinets as indicated on the drawings.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.

2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
3. Finishes:

a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: Galvanized steel or Same finish as panels and trim.

4. Directory Card: Inside panelboard door, mounted in transparent card holder

C. Incoming Mains Location: Top or bottom to match feeder locations.

D. Phase, Neutral, and Ground Buses:

1. Material: Tin-plated aluminum or Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Tin-plated aluminum or Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

I. Selective Coordination: Provide overcurrent protective devices that selective coordinate in accordance with code requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 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."

B. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 2.

2.03 DISTRIBUTION PANELBOARDS

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. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: Circuit breaker or Lugs only as scheduled.

E. AIC ratings shall align with the results of the fault study.

F. Arc Flash labels shall be applied in accordance with arc flash study.

G. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

H. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.04 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

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. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only as scheduled.

D. AIC ratings shall align with the results of the fault study.

E. Arc Flash labels shall be applied in accordance with arc flash study.

F. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

G. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

H. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.05 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

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. Molded-Case Circuit Breaker (MCCB): 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. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
4. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
5. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
6. Molded-Case Circuit-Breaker (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 materials.
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. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at percent of rated voltage.
e. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
f. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
g. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
h. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
i. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
j. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.06 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NECA 407.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.02 INSTALLATION

A. Install panelboards and accessories according to NECA 407.

B. Mount top of trim 90 inches above finished floor unless otherwise indicated.

C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

D. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

E. Install filler plates in unused spaces.

F. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

G. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

H. Comply with NECA 1.

3.03 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 26 05 53 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

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.

C. Panelboards will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

END OF SECTION

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.

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) - WRSGF20.
    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.

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 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.

2.02 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.

2.03 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.

2.04 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.

2.05 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 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.

2.02 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.

2.03 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, notifyArchitect 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."

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."

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 Color Retention: Five years from date of Substantial Completion.
3. 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.

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 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.

2.02 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."

2.03 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**

2.04 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.

2.05 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.

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, NTRL 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.

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

SECTION 31 00 00
EARTHWORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Work described by this Section consists of all earthwork encountered and necessary for construction of the project as indicated in the Contract Documents, and includes but is not limited to the following:

1. Excavation
2. Backfilling and Filling
3. Compaction
4. Embankment Construction
5. Grading
6. Providing soil material as necessary
7. Disposal of excess suitable material and unsuitable materials

B. Related Work Specified Elsewhere: (When Applicable)

1. Clearing and Grubbing, Dewatering, Filter Fabric, Temporary Erosion Control, Stripping and Stockpiling of Topsoil, Sheeting, Landscaping, and Paving are specified in the appropriate sections of this Specification.

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. All work shall be performed and completed in accordance with all local, state and federal regulations.
2. The General Contractor shall secure all other necessary permits unless otherwise indicated from, and furnish proof of acceptance by, the municipal and state departments having jurisdiction and shall pay for all such permits, except as specifically stated elsewhere in the Contract Documents.

B. Line and Grade:

1. The Contractor shall establish the lines and grades in conformity with the Drawings and maintain same to properly perform the work.

C. Testing Methods:

1. Gradation Analysis: Where a gradation is specified the testing shall be in accordance with ASTM C-117-90 and ASTM C-136-93 (or latest revision).
2. Compaction Control:
   a) Unless otherwise indicated, wherever a percentage of compaction for backfill is indicated or specified, it shall be the in-place density divided by the maximum density and multiplied by 100. The maximum density shall be the density at optimum moisture as determined by ASTM Standard Methods of Test for Moisture-Density Relations of Soil Using 10-lb. Hammer and 18-in. Drop, Designation D-1557-91 (Modified Proctor), or latest revision, unless otherwise indicated.
   b) The in-place density shall be determined in accordance with ASTM Standard Method of Test for Density of Soil in Place by the Sand Cone method,

Designation D 1556-90, (or latest revision) or Nuclear method Designation D2922.

c) Wherever specifically indicated, maximum density at optimum moisture may be determined by ASTM Standard Methods of Test for Moisture Density Relations of Soils, ASTM D-698-91 (Standard Proctor).

d) An Independent Testing Laboratory will be retained by the Owner to conduct all laboratory and field soil sampling and testing, and to observe earth work and foundation construction activities. Laboratory testing will consist of sieve analyses, natural water content determinations, and compaction tests. Field testing will consist of in-place field density tests and determination of water contents.

1.3 SUBMITTALS

A. Collection of samples and testing of all materials for submittals shall be performed by the Independent Testing Laboratory and paid for by the Contractor until the materials are approved by the Owner or Engineer.

B. Submit test results in accordance with the procedure specified in the General and Supplementary Conditions.

C. Submit test results (including gradation analysis) and source location for all borrow material to be used at least 10 working days prior to its use on the site. Contractor shall identify and provide access to borrow sites.

D. Submit moisture density curve for each type of soil (on site or borrow material) to be used for embankment construction or fill beneath structures or pavement.

1.4 TESTS

The Independent Testing Laboratory shall conform to the following procedures and standards:

A. Submit test results in accordance with the procedure specified in the General and Supplementary Conditions.

B. All testing shall be performed by a qualified Independent Testing Laboratory acceptable to the Engineer and Contractor at the Owner's expense unless otherwise indicated.

C. Field density tests on embankment materials shall be as follows:

1. Tests shall be taken on every 200 cubic yards of embankment material.

D. Paved Areas and Building Slab Subgrade: Make at least one field density test of subgrade for every 2,000 sq. ft. of paved area or building slab, but in no case less than 3 tests. In each compacted fill layer, make one field density test for every 2,000 sq. ft. of overlaying building slab or paved area, but in no case less than 3 tests.

E. Trenches: Field density test in trenches shall be taken at 75 linear foot intervals on every third lift.

F. Foundation Wall Backfill: Take at least one (1) field density tests per lift per wall at locations and elevations as designated by the Engineer.

G. In addition to the above tests the Independent Testing Laboratory will perform additional density tests at locations and times requested by the Engineer.

H. Additional density testing will be required by the Engineer if the Engineer is not satisfied with the apparent results of the Contractor's compaction operation.

1. If the test results fail to meet the requirements of these specifications, the Contractor shall undertake whatever action is necessary, at no additional cost to the Owner, to obtain the required compaction. The cost of retesting will be paid by Owner. The cost of retesting will be determined by Engineer and Owner will invoice Contractor for this cost. If unpaid after 60 days, the invoice amount for retesting will be deducted from the Contract Price. No allowance will be considered for delays in the performance of the work.
2. If the test results pass and meet the requirements of these Specifications, the cost of the testing service will be borne by the Owner, but no allowance will be considered for delays in the performance of the work.

1.5 JOB CONDITIONS

A. Site Information:

1. Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that Owner and Engineer will not be responsible for interpretations or conclusions drawn therefrom by the Contractor. Data are made available for the convenience of Contractor.
2. Additional test borings and other exploratory operations may be made by Contractor at no additional cost to Owner.

B. Existing Utilities and Structures:

1. The locations of utilities and structures shown on the Drawings are approximate as determined from physical evidence on or above the surface of the ground and from information supplied by the utilities. The Engineer in no way warranties that these locations are correct. It shall be the responsibility of the Contractor to determine the actual locations of any utilities or structures within the project area.

PART 2 - PRODUCTS

2.1 SOIL MATERIAL

A. Aggregate Base (MDOT 703.06 Type A): Shall be screened or crushed gravel of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances. Type A Aggregate for base shall not contain particles of rock that will not pass the 3-inch square mesh sieve. The gradation of the part that passes a 3-inch sieve shall meet the following grading requirements:

Sieve Designation	Percent by Weight Passing Square Mesh Sieves
1/2 inch	45-70
1/4 inch	30-55
No. 40	0-20
No. 200	0-6

B. Aggregate Subbase Course (MDOT 703.06 Type D): Shall be screened or crushed gravel consisting of hard durable particles which are free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation of the portion of the material passing the 3-inch sieve shall meet the grading requirements of the following table and shall not contain particles of rock that will not pass the 3-inch square mesh:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves
½ inch	35-80
¼ inch	25-65
No. 40	0-30
No. 200	0-7

C. Underdrain Backfill Material (MDOT 703.22 Type B): Material for underdrain shall be free from organic matter, frozen material and shall conform to the following table:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves
1 inch	95-100
1/2 inch	75-100
No. 4	50-100
No. 20	15-80
No. 50	0-15
No. 200	0-5

C. Common Borrow: Shall consist of approved material required for the construction of the work where designated. Common borrow shall be non-organic compactable earth meeting the requirements of 2020 Maine DOT Standard Specifications 703.18 Common Borrow.

D. Granular Borrow: Used for backfill for over excavations and fil to raise grades in building and paved areas shall meet the requirements of 2020 Maine DOT Standard Specifications 703.19 Granular Borrow.

E. Crushed Stone: Shall be a uniform material consisting of clean, hard, and durable particles or fragments, free from vegetable or other objectionable matter, containing angular pieces, as are those which come from a mechanical crusher. Gradation requirements shall be as follows:

Sieve Designation	Percent by Weight Passing Square Mesh Sieve
1 inch	100
3/4 inch	90-100
1/2 inch	20-55
3/8 inch	0-15
No. 4	0-5

F. Crusheded Stone: Shall be a well graded stone consisting of clean, hard, and durable particles or fragments, free from vegetable or other objectionable matter, meeting the following gradation requirements:

Sieve Designation	Percent by Weight Passing Square Mesh Sieve
1 inch	100
3/4 inch	90-100

3/8 inch	20-55
No. 4	0-15
No. 8	0-5

G. Structural Fill : Shall consist of well graded granular material free of organic material, loam, wood, trash, snow, ice, frozen soil and other objectionable material and having no rocks with a maximum dimension of over 4 inches and meeting the following gradation requirements, except where it is used for pipe bedding in which case the maximum size shall be 2 inches.

Sieve Designation	Percent by Weight Passing Square Mesh Sieve
4 inch	100
3 inch	90-100
¼ inch	25-90
No. 40	0-30
No. 200	0-6

H. Sand: Shall be well graded durable material free of organic matter and conform to the following gradation requirements:

Sieve Designation	Percent by Weight Passing Square Mesh Sieve
3/8 inch	100
No. 4	95-100
No. 16	50-85
No. 50	10-30
No.100	2-10
No.200	0-5

Sand conforming to the requirement for fine aggregate in ASTM Standard Specifications for Concrete Aggregate, Designation C-33, will meet the above requirement.

2.3 FILTER FABRIC

A. If filter fabric is required, refer to Section 31 05 19.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions under which excavating, backfilling, filling, compaction and grading are to be performed and notify the Engineer in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 EXCAVATION

A. General:

1. Excavation consists of removal and disposal of all material encountered when establishing line and grade elevations required for execution of the work.

2. The Contractor shall make excavations in such manner and to such widths as will give suitable room for building the structures or laying and jointing the piping; shall furnish and place all sheeting, bracing, and supports; shall do all cofferdamming, pumping, and draining; and shall render the bottom of the excavations firm, dry and acceptable in all respects.
3. All excavation shall be classified as either earth or ledge.
    a) Earth Excavation shall consist of the removal, hauling and disposal of all earth materials encountered during excavation including but not limited to native soil or fill, pavement (bituminous or concrete), existing sewers and manholes, ashes, loam, clay, swamp muck, debris, soft or disintegrated rock or hard pan which can be removed with a backhoe, or a combination of such materials, and boulders that do not meet the definition of "Ledge" below.
    b) Ledge Excavation: Shall consist of the removal, hauling, and disposal of all ledge or rock encountered during excavation. "Ledge" and "rock" shall be defined as any natural compound, natural mixture that in the opinion of the Engineer can be removed from its existing position and state only by drilling and blasting, wedging, sledging, boring or breaking up with power operated tools. No boulder, ledge, slab, or other single piece of excavated material less than two cubic yards in total volume shall be considered to be rock unless, in the opinion of the Engineer it must be removed from its existing position by one of the methods mentioned above.
4. The Contractor shall not have any right of property in any materials taken from any excavation. Do not remove any such materials from the construction site without the approval of the Engineer. This provision shall in no way relieve the Contractor of their obligations to remove and dispose of any material determined by the Engineer to be unsuitable for backfilling. The Contractor shall dispose of unsuitable and excess material in accordance with the applicable sections of the Contract Documents.

B. Additional Excavation: When excavation has reached required subgrade elevations, notify the Engineer and Resident Project Representative who will observe the conditions.
1. If material unsuitable for the structure or paved area or pipeline (in the opinion of the Engineer) is found at or below the grade to which excavation would normally be carried in accordance with the Drawings and/or Specifications, the Contractor shall remove such material to the required width and depth and replace it with thoroughly compacted select fill, screened stone, crushed stone, or concrete as directed by the Engineer.
2. All excavated materials designated by the Engineer as unsuitable shall become the property of the Contractor and disposed of at locations in accordance with all State and local laws and the provisions of the Contract Documents.

C. Unauthorized Excavation: Shall consist of removal of materials beyond indicated subgrade elevations or dimensions without specific authorization of Engineer. Unauthorized excavation, as well as remedial work required by the Engineer shall be at the Contractor's expense. Remedial work required is as follows:
1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation with select fill or screened stone compacted to 95%. Provide 12" minimum select fill or screened stone directly under footings. Concrete fill may be used to bring elevations to proper position, when acceptable to Engineer.
2. If the bottom of a trench is excavated beyond the limits indicated, backfill the resulting void with thoroughly compacted screened stone, unless otherwise indicated.
3. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Engineer.

D. Structural Excavation:

1. Shall consist of the removal, hauling, disposal, of all material encountered in the excavation to permit proper installation of structures.
2. Excavations for structures shall be carried to the lines and subgrades shown on the Drawings.
3. Excavate areas large enough to provide suitable room for building the structures.
4. The extent of open excavation shall be controlled by prevailing conditions subject to any limits designated by the Engineer.
5. Provide, install, and maintain sheeting and bracing as necessary to support the sides of the excavation and to prevent any movement of earth which could diminish the width of the excavation or otherwise injure the work, adjacent structures, or persons and property in accordance with all state and OSHA safety standards.
6. Erect suitable fences around structure excavation and other dangerous locations created by the work, at no additional cost to the Owner.
7. Exposed subgrade surfaces shall remain undisturbed, protected, and maintained as uniform, plane areas and shape to receive the foundation components of the structure.
    a. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10', and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.
    b. In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade and trim bottoms to required lines and grades to leave solid base to receive the structure.
    c. If a structure is to be constructed within the embankment, the fill shall first be brought to a minimum of 3 feet above the base of the footing. A suitable excavation shall then be made as though the fill were undisturbed earth.

E. Trench Excavation: Shall consist of removal, hauling and disposal of all material encountered in the excavation to the widths and depths shown on the Drawings to permit proper installation of underground utilities.

1. Excavate trenches to the uniform width shown on the Drawings sufficiently wide to provide sufficient space for installation, backfilling, and compaction. Every effort should be made to keep the sides of the trenches firm and undisturbed until backfilling has been completed and consolidated.
2. Trenches shall be excavated with approximately vertical sides between the elevation of the center of the pipe and an elevation one foot above the top of the pipe.
3. Grade bottoms of trenches as indicated for pipe and bedding to establish the indicated slopes and invert elevations, notching under pipe joints to provide solid bearing for the entire body of the pipe, where applicable.
4. If pipe is to be laid in embankments or other recently filled material, the material shall first be placed to the top of the fill or to a height of at least two feet above the top of the pipe, whichever is the lesser. Particular care shall be taken to ensure maximum consolidation of material under the pipe location. The pipe trench shall be excavated as though in undisturbed material.
5. Unless otherwise specifically directed or permitted by the Engineer, begin excavation at the low end of sewer and storm lines and proceed upgrade.
6. Perform excavation for force mains and water mains in a logical sequence.
7. The extent of open excavation shall be controlled by prevailing conditions subject to any limits prescribed by the Engineer.

8. As the excavation progresses, install such shoring and bracing necessary to prevent caving and sliding and to meet the requirements of the state and OSHA safety standards, as outlined in the appropriate section of this Specification.

F. Protection of Persons, Property and Utilities:

1. Barricade open excavations occurring as part of this work and post with warning lights in compliance with local and State regulations.
2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations. Exercise extreme caution and utilize sheeting, bracing, and whatever other precautionary measures that may be required.
3. Rules and regulations governing the respective utilities shall be observed in execution of all work. Active utilities and structures shall be adequately protected from damage, and removed or relocated only as indicated or specified. Inactive and abandoned utilities encountered in excavation and grading operations shall be removed, plugged or capped only with written authorization of the utility owner. Report in writing to the Engineer, the locations of such abandoned utilities. Extreme care shall be taken when performing work in the vicinity of existing utility lines, utilizing hand excavation in such areas, as far as practicable.
4. Repair, or have repaired, all damage to existing utilities, structures, lawns, other public and private property which results from construction operations, at no additional expense to the Owner, to the complete satisfaction of the Engineer, the utility, the property owner, and the Owner.

G. Use of Explosives:

1. Do not bring explosives onto site or use in work without prior written permission from authorities having jurisdiction. Contractor is solely responsible for handling, storage, and use of explosive materials when their use is permitted.
2. All blasting shall be performed in accordance with all pertinent provisions of the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America, Inc.

H. Stability of Excavations:

1. Slope sides of excavations to comply with all codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
2. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.

I. Shoring and Bracing:

1. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition.
2. Provide trench shoring and bracing to comply with local codes and authorities having jurisdiction. Refer to Specification Section 31 41 00.
3. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Install shoring and bracing as excavation progresses.

J. Material Storage:

1. Stockpile excavated materials which are satisfactory for use on the work until required for backfill or fill. Place, grade and shape stockpiles for proper drainage and protect with temporary seeding or other acceptable methods to control erosion.

2. Locate and retain soil materials away from edge of excavations.
3. Dispose of excess soil material and waste materials as herein specified.

K. Dewatering:

1. To ensure proper conditions at all times during construction, the Contractor shall provide and maintain ample means and devices (including spare units kept ready for immediate use in case of breakdowns) with which to intercept and/or remove promptly and dispose properly of all water entering trenches and other excavations (including surface and subsurface waters).
2. Excavations shall be kept dry until the structures, pipes, and appurtenances to be built therein have been completed to such extent that they will not be floated or otherwise damaged.

L. Cold Weather Protection:

1. Protect excavation bottoms against freezing when atmospheric temperature is less than 35°F.
2. No frozen material shall be used as backfill or fill and no backfill shall be placed on frozen material.

M. Separation of Surface Material:

1. The Contractor shall remove only as much of any existing pavement as is necessary for the prosecution of the work.
2. Prior to excavation, existing pavement shall be cut where in the opinion of the Engineer it is necessary to prevent damage to the remaining road surface.
3. Where pavement is removed in large pieces, it shall be disposed of before proceeding with the excavation.
4. From areas within which excavations are to be made, loam and topsoil shall be carefully removed and separately stored to be used again as directed; or, if the Contractor prefers not to separate surface materials, they shall furnish, as directed, loam and topsoil at least equal in quantity and quality to that excavated.

N. Dust Control:

1. During the progress of the work, the Contractor shall conduct their operations and maintain the area of their activities, including sweeping and sprinkling of streets as necessary, so as to minimize the creation and dispersion of dust. Refer to Specification Section 31 25 00.
2. If the Engineer decides that it is necessary to use calcium chloride for more effective dust control, the contractor shall furnish and spread the material, as directed.

3.3 BACKFILL AND FILL

A. General:

1. Backfilling shall consist of replacing material removed to permit installation of structures or utilities, as indicated in the Contract Documents.
2. Filling shall consist of placing material in areas to bring them up to grades indicated on the Drawings.
3. The Contractor shall provide and place all necessary backfill and fill material, in layers to the required grade elevations.
4. Backfill excavations as promptly as work permits, but not until completion of the following:

a. Acceptance by Engineer of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
b. Inspection, approval, and recording locations of underground utilities.
c. Removal of concrete formwork.
d. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Temporary sheet piling driven below bottom of structures shall be removed in manner to prevent settlement of the structure or utilities, or cut off and left in place if required.
e. Removal of trash and debris.
f. Permanent or temporary horizontal bracing is in place on horizontally supported walls.
g. Density testing having results meeting requirements specified herein.

5. In general, and unless otherwise indicated, material used for backfill of trenches and excavations around structures shall be suitable excavated material which was removed in the course of making the construction excavation. Unless otherwise specified or allowed by the Engineer the backfill and fill shall be placed in layers not to exceed 8 inches in thickness.
6. All fill and backfill under structures and pavement, and adjacent to structures, shall be compacted crushed stone or select fill as specified or as indicated on the Drawings. The fill and backfill materials shall be placed in layers not exceeding 8 inches in thickness.
7. All structures (including manholes) shall be placed on a 6-inch mat of screened stone unless otherwise indicated.
8. Suitable excavated material shall meet the following requirements:
   a. Free from large clods, silt lumps or balls of clay.
   b. Free from stones and rock fragments with larger than 12 inch max. dimension.
   c. Free from organics, peat, etc.
   d. Free from frozen material.
9. If sufficient suitable excavated material is not available from the excavations, and where indicated on the Drawings, the backfill material shall be select fill or common borrow, unless otherwise indicated, as required and as directed by the Engineer.
10. Do not backfill with, or on, frozen materials.
11. Remove, or otherwise treat as necessary, previously placed material that has frozen prior to placing backfill.
12. Do not mechanically or hand compact material that is, in the opinion of the Engineer, too wet.
13. Do not continue backfilling until the previously placed and new materials have dried sufficiently to permit proper compaction.
14. The nature of the backfill materials will govern the methods best suited for their placement and compaction. Compaction methods and required percent compaction is covered in Compaction section.
15. Before compaction, moisten or aerate each layer as necessary to provide a water content necessary to meet the required percentage of maximum dry density for each area classification specified.
16. Do not allow large masses of backfill material to be dropped into the excavation in such a manner that may damage pipes and structures.
17. Place material in a manner that will prevent stones and lumps from becoming nested.

18. Completely fill all voids between stones with fine material.
19. Do not place backfill on or against new concrete until it has attained sufficient strength to support loads without distortion, cracking, and other damage.
20. Deposit backfill and fill material evenly on all sides of structures to avoid unequal soil pressures.
21. Keep stones or rock fragments with a dimension greater than two inches at least one foot away from the pipe or structure during backfilling.
22. Leave sheeting in place when damage is likely to result from its withdrawal.
23. Completely fill voids left by the removal of sheeting with screened stone which is compacted thoroughly.

B. Pipe Bedding, Initial Backfill and Trench Backfill

1. Place bedding and backfill in layers of uniform thickness specified herein, and as shown on the Drawings.
2. Thoroughly compact each layer by means of a suitable vibrator or mechanical tamper.
3. Install pipe bedding and initial backfill in layers of uniform thickness not greater than eight (8) inches.
4. Deposit the remainder of the backfill in uniform layers not greater than eight inches.
5. Provide underground sewer marking tape for the full length of sewer trenches as shown on the Drawings. Marking tape shall be SETON #210 SEW or equivalent.
6. Where soft silt and clay soils are encountered the trench shall be excavated six inches below the normal bedding and backfilled with 6-inches of compacted sand.
7. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings and which are carried below the bottom of such footings, or which pass under wall footings. Place concrete to the level of the bottom of adjacent footings.
8. The following schedule lists the bedding materials for various types of pipe. Refer to the pipe trench detail for dimensional requirements.

BEDDING REQUIREMENTS

DI or Concrete Pipe	screened stone or select fill.
PVC or PE Pipe	screened stone.

9. The following schedule lists the initial backfill requirements for various types of pipes. Refer to the pipe trench detail for dimensional requirements.

INITIAL BACKFILL REQUIREMENTS

DI or Concrete, Pipe	Screened stone or select fill
PVC or PE Pipe	Screened stone

10. Special bedding and backfill requirements shown on the Drawings supersede requirements of this section.

11. Where pipes or structures pass through or under the impervious core of the lagoon embankments, bedding and backfill material shall consist of the impervious embankment material. Extra care should be given to properly and thoroughly compact the bedding material around the pipe.

C. Improper Backfill:

1. When excavation and trenches have been improperly backfilled, and when settlement occurs, reopen the excavation to the depth required, as directed by the Engineer.
2. Refill and compact the excavation or trench with suitable material and restore the surface to the required grade and condition.
3. Excavation, backfilling, and compacting work performed to correct improper backfilling shall be performed at no additional cost to the Owner.

D. Ground Surface Preparation:

1. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, scarify or break-up sloped surface steeper than 1 vertical to 4 horizontal.
2. When existing ground surface has a density less than that specified under "compaction" for the particular area classification, break up the ground surface, pulverize, moisture-condition to the optimum moisture content, and compact to required depth and percentage of maximum density.

3.4 COMPACTION

A. General:

1. Control soil compaction during construction to provide not less than the minimum percentage of density specified for each area classification.

B. Percentage of Maximum Density Requirements:

1. Compact soil to not less than the following percentages of maximum dry density determined in accordance with ASTM D1557 as indicated.
    a. Structures: Compact each layer of backfill or fill material below or adjacent to structures to at least 95% of maximum dry density (ASTM D1557).
    b. Off Traveled Way Areas: Compact each layer of backfill or fill material to at least 90% of maximum dry density (ASTM D1557).
    c. Walkways: Compact each layer of backfill or fill material to at least 93% of maximum dry density (ASTM D1557).
    d. Roadways, Drives and Paved Areas: Compact each layer of fill, subbase material, and base material to at least 95% of maximum dry density (ASTM D1557).
    e. Pipes: Compact bedding material and each layer of backfill to at least 90% maximum dry density (ASTM D1557). Where backfilling with excavated material, compact to native field density.
    f. Embankments: Compact each layer of embankment material to at least 95% of maximum dry density (ASTM D1557).

C. Moisture Control:

1. Where subgrade or a layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, in quantities controlled to prevent free water appearing on surface during or subsequent to compaction operations.

2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
3. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory level.

D. Embankment Compaction:

1. After each embankment layer has been spread to the required maximum 8-inch thickness and its moisture content has been adjusted as necessary, it shall be rolled with a sufficient number of passes to obtain the required compaction. One pass is defined as the required number of successive trips which by means of sufficient overlap will insure complete coverage and uniform compaction of an entire lift. Additional passes shall not be made until the previous pass has been completed.
2. When any section of an embankment sinks or weaves excessively under the roller or under hauling units and other equipment, it will be evident that the required degree of compaction is not being obtained and that a reduction in the moisture content is required. If at any place or time such sinking and weaving produces surface cracks which, in the judgment of the Engineer are of such character, amount, or extent to indicate an unfavorable condition, they will recommend operations on that part of the embankment to be suspended until such time as it shall have become sufficiently stabilized. The ideal condition of the embankment is that attained when the entire embankment below the surface being rolled is so firm and hard as to show only the slightest weaving and deflection as the roller passes.
3. If the moisture content is insufficient to obtain the required compaction, the rolling shall not proceed except with the written approval of the Engineer, and in that event, additional rolling shall be done to obtain the required compaction. If the moisture content is greater than the limit specified, the material of such water content may be removed and stockpiled for later use or the rolling shall be delayed until such time as the material has dried sufficiently so that the moisture content is within the specified limits. No adjustment in price will be made on account of any operation of the Contractor in removing and stockpiling, or in drying the materials or on account of delays occasioned thereby.
4. If because of insufficient overlap, too much or too little water, or other cause attributable to defective work, the compaction obtained over any area is less than that required, the condition shall be remedied, and if additional rollings are ordered, they will be done at no cost to the Owner. If the material itself is unsatisfactory or if additional rolling or other means fails to produce satisfactory results, the area in question shall be removed down to material of satisfactory density and the removal, replacement, and re-rolling shall be done by the Contractor, without additional compensation.
5. Material compaction by hand-operated equipment or power-driven tampers shall be spread in layers not more than 6 inches thick. The degree of compaction obtained by these tamping operations shall be equal in every respect to that secured by the rolling operation.

E. Compaction Methods: The Contractor may select any method of compaction that is suitable to compact the material to the required density.

1. General: Whatever method of compacting backfill is used, care shall be taken that stones and lumps shall not become nested and that all voids between stones shall be completely filled with fine material. All voids left by the removal of sheeting shall be completely backfilled with suitable materials and thoroughly compacted.

2. Tamping or Rolling: If the material is to be compacted by tamping or rolling, the material shall be deposited and spread in uniform, parallel layers not exceeding the uncompacted thicknesses specified. Before the next layer is placed, each layer shall be tamped as required so as to obtain a thoroughly compacted mass. Care shall be taken that the material close to the excavation side slopes, as well as in all other portions of the fill area, is thoroughly compacted. When the excavation width and the depth to which backfill has been placed are sufficient to make it feasible, and it can be done effectively and without damage to the pipe or structure, backfill may, on approval, be compacted by the use of suitable rollers, tractors, or similar powered equipment instead of by tamping. For compaction by tamping or rolling, the rate at which backfilling material is deposited shall not exceed that permitted by the facilities for its spreading, leveling, and compacting as furnished by the Contractor.

F. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.

3.5 GRADING:

A. General:
1. Grading shall consist of that work necessary to bring all areas to the final grades.
2. Uniformly grade areas within limits of work requiring grading, including adjacent transition areas.
3. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

B. Grading Outside Building Lines:
1. Grade areas adjacent to building to drain away from structures and to prevent ponding.
2. Grade surfaces to be free from irregular surface changes, and as follows:
a. Lawn or Unpaved Areas: Finish grade areas to receive topsoil to within not more than 1" above or below the required subgrade elevations.
b. Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 1/2" above or below the required subgrade elevation.
c. Pavements: Shape surface of areas under pavement to line, grade and cross-section, with finish surface not more than 3/8" above or below the required subgrade elevation.

C. Grading Surface of Fill Under Building Slabs:
1. Grade surface to be smooth and even, free of voids, and compacted as specified, to the required elevation.
2. Provide final grades within a tolerance of 1/2" when tested with a 10' straight edge.

D. Compaction:
1. After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

E. Protection of Graded Areas:

1. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
2. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

3.6 BASE COURSE AND LEVELING COURSE

A. General:

1. Base course consists of placing the specified materials in layers to support a leveling course or paved surface, as indicated in the Drawings.

B. Grade Control:

1. During construction, maintain lines and grades including crown and cross-slope of base course and leveling course.

C. Placing:

1. Place base course on prepared subbase conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting base materials.
2. Place leveling course on prepared base course, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compaction.

D. Shaping and Compacting:

1. All layers of aggregate base course and leveling course shall be compacted to the required density immediately after placing. As soon as the compaction of any layer has been completed, the next layer shall be placed.
2. The Contractor shall bear full responsibility for and make all necessary repairs to the base leveling courses and the subgrade until the full depth of the base leveling courses is placed and compacted. Repairs shall be made at no additional cost to the Owner.
3. If the top of any layer of the aggregate base or leveling course becomes contaminated by degradation of the aggregate or addition of foreign materials, the contaminated material shall be removed and replaced with the specified material at the Contractor's expense.

END OF SECTION

SECTION 31 05 19

FILTER FABRIC AND GEO-MEMBRANE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Furnish all materials and install filter fabric and geo-membrane of the types, dimensions and in the location(s) shown on the Drawings and specified herein.

B. Related Work Specified Elsewhere:

1. Earthwork, Temporary Erosion Control, Riprap and Stone Ditch Protection are specified in the appropriate sections of this Division.

1.3 QUALITY ASSURANCE

A. A competent laboratory must be maintained by the manufacturer of the fabric and geo-membrane at the point of manufacture to ensure quality control.

B. During all periods of shipment and storage, the fabric shall be wrapped in a heavy duty protective covering to protect the fabric from direct sunlight, ultraviolet rays, temperatures greater than 140°F, mud, dirt, dust and debris.

1.3 SUBMITTALS

A. Manufacturer shall furnish certified test reports with each shipment of material attesting that the fabric meets the requirements of this Specification.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Filter fabric for use in stabilization, drainage, underdrains, landscaping and beneath structures shall be formed in widths of not less than six (6) feet and shall meet the requirements of Table 1. Both woven and non-woven geotextiles are acceptable; however no "slit-tape" woven fabrics will be permitted for drainage, underdrain, and erosion control applications.

Table 1

Geotextile Mechanical Property	Test Method	Minimum Permissible Value
Grab Tensile Strength	ASTM D4632	120 pounds
Grab Elongation	ASTM D4632	50 percent
CBR Puncture	ASTM D6241	310 psi
Trapezoid Tear Strength	ASTM D4533	50 pounds
Water Flow Rate	ASTM D4491	120 gal/min/sf
Equivalent Opening Size (EOS)	ASTM D4751	U.S. Std. Sieve #80

Coefficient of Permeability	ASTM D4491-85	0.2 cm/sec

The geotextile shall have property values expressed in "typical" values that meet or exceed the values stated above as determined by the most recent test methods specified above.

B. Filter fabric for use in reinforcement shall meet the requirements of Table 2. Woven and non-woven geotextiles are acceptable.

Table 2

Geotextile Mechanical Property	Test Method	Minimum Permissible Value
Grab Tensile Strength (both directions)	ASTM 4595-86	195 pounds
Grab Elongation	ASTM D4632-86	20 percent
CBR Puncture	ASTM D6241	700 pounds
Trapezoid Tear Strength	ASTM D4533-85	85 pounds
Equivalent Opening Size (EOS)	ASTM D4751	U.S. Std. Sieve number(s) between #20 and #100

The geotextile shall meet or exceed the "typical" values stated above as determined by the most recent test methods specified above.

C. Filter Fabric for use under riprap shall meet the requirements as specified in Section 31 37 00 - Riprap.

D. For Silt Fence, refer to Section 31 25 00 – Erosion and Sedimentation Controls.

E. Geo-membrane used under stormwater filters shall be impermeable 20 mil HDPE or LLDPE.

1. The materials supplied under these Specifications shall consist of first-quality 100% virgin products designed and manufactured specifically for the purpose of this work, which shall have been satisfactorily demonstrated, by prior use, to be suitable and durable for such purposes.
2. LLDPE Geomembrane Materials:
   a. LLDPE Geomembrane shall be manufactured to meet the following requirements:
   (1) Provide finished product free from holes, pin holes, bubbles, blisters, excessive gels, undispersed resins and/or carbon black, or contamination by foreign matter.

   (2) LLDPE Geomembrane shall be a very flexible Linear Low Density Polyethylene Geomembrane containing carbon black for UV stability and contain no plasticizers.

PART 3 - EXECUTION

3.1 Install filter fabric as shown on the Drawings or as directed in appropriate specifications in this division or in accordance with manufacturer's instructions or as directed by the Engineer.

END OF SECTION

SECTION 31 11 00
CLEARING AND GRUBBING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Clearing includes, but is not limited to, removal of trees, brush, stumps, wooded growth, grass, shrubs, poles, posts, signs, fences, culverts and other vegetation and minor structures; the protection of designated wooded growth; the storage and protection of minor structures and materials which are to be replaced; and the disposal of nonsalvageable structures and materials, and necessary preliminary grading.

B. Limits of Work:

1. Perform clearing and grubbing work within the areas required for construction, or as shown on the Drawings, to a depth of l2 inches below the existing grade.
2. Perform additional clearing and grubbing work within areas and to depths which, in the opinion of the Engineer, interfere with excavation and/or construction, or are otherwise objectionable.

C. Work Not Included:

1. Clearing and grubbing work performed for the convenience of the Contractor will not be considered for payment.

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Dispose of material in accordance with all applicable local and state laws, ordinances and code requirements.

B. Remove and dispose of nonsalvageable structures and material in accordance with all applicable local and state laws, ordinances and code requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide all materials required to complete the work.

B. All timber and wood shall become the property of the Contractor unless other agreements are made between the Owner and the Contractor.

C. Repair any damage to structures to the complete satisfaction of the Owner and Engineer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Carefully preserve and protect from injury all trees and/or shrubs not to be removed.

B. Right-of-way:

1. Where excavation is required on public or private rights-of-way containing trees, shrubs, other growth, or any structure or construction, obtain the Engineer's direction

concerning the extent to which such obstacles can be cleared or stripped prior to performing the Work.

2. In all rights-of-way, remove only those particular growths or structures which are, in the opinion of the Engineer, essential for construction operations.
3. All other removals or damage shall be replaced or restored at the Contractor's expense.

3.2 PERFORMANCE

A. Clearing:
1. Remove and dispose of all trees, brush, slash, stubs, bushes, shrubs, plants, debris and obstructions within the area to be cleared, except any areas that may be designated as "Selective Clearing", and except as otherwise shown on the Drawings or as directed by the Engineer.
2. Remove all stumps unless otherwise directed by the Engineer.
3. Dispose of material to be removed daily as it accumulates.
4. Take special care to completely dispose of all elm trees and branches immediately after cutting either by burial in approved locations or, when permitted, by burning in areas well removed from standing elm growth.

B. Protection of Wooded Growth:
1. Fell trees toward the center of the area being cleared to protect trees and shrubs to be left standing.
2. Cut up, remove and dispose of trees unavoidably falling outside the area to be cleared.
3. Employ skilled workmen or tree surgeons to trim and repair all trees that are damaged but are to be left standing.

C. Selective Clearing:
1. When shown on the Drawings and when directed by the Engineer, perform selective clearing work to preserve natural tree cover.
2. Perform selective clearing work only under the direction and supervision of the Engineer.
3. Remove all dead and uprooted trees, brush, roots and other material which, in the opinion of the Engineer, are objectionable.
4. Cut flush with the ground and remove only those trees indicated by the Engineer.
5. Employ skilled workmen or tree surgeons to carefully trim all branches requiring cutting on trees to be left standing. Wood exposed as the result of removal of branches is to be left exposed to air and sunlight.
6. Bituminous paint shall not be used on wood exposed as a result of branch removal, excavation around roots, or damage to tree bark.

D. Grubbing:
1. Perform grubbing work beneath new roads, driveways, walks, seeded areas and other areas and as directed by the Engineer.
2. Grub out all sod, vegetation and other objectionable material to a minimum depth of l2 inches below the existing grade.
3. Completely remove all stumps, including major root systems.

E. Disposal:

1. Remove from the site and dispose of material not being reused.
2. Provide an approved disposal area unless otherwise specified.

F. Burning:

1. Burning of combustible materials on site will not be allowed.

3.3 REPLACEMENT OF MATERIALS

A. Paving, Curbing and Miscellaneous Material:

1. Remove all paving, subpaving, curbing, gutters, brick, paving block, granite curbing, flagging and minor structures that are over the area to be filled or excavated.
2. Remove and replace bituminous asphaltic and portland cement concrete in accordance with the appropriate sections of these Specifications.
3. Properly store and preserve all material to be replaced in a location approved by the Engineer.

B. Shrubs and Bushes:

1. Remove, store, and replace ornamental shrubs and bushes to be preserved in accordance with accepted horticultural practices.

C. Topsoil:

1. When applicable, carefully remove, store, and protect topsoil in accordance with the appropriate section of this division.

D. Responsibility:

1. Replace, at no additional cost to the Owner, materials lost or damaged because of careless removal or neglectful or wasteful storage, disposal or use of these materials.

END OF SECTION

SECTION 31 23 19
TEMPORARY CONSTRUCTION DEWATERING SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Design, furnish, operate, maintain, and remove temporary dewatering system to lower and control ground water table levels and hydrostatic pressures to permit excavation, backfill, and construction to be performed in the dry; collect and dispose of ground and surface water where necessary to complete the work.
2. Design, furnish, operate, maintain, and remove temporary treatment system for temporary dewatering system effluent prior to discharge.
3. Conduct structure monitoring, as specified herein.
4. Conduct compliance testing, as specified herein and in accordance with the requirements of the permitting authority.
5. Install and protect observation wells to monitor groundwater levels during excavation and backfill activities.

1.2 REQUIREMENTS SPECIFIED ELSEWHERE

A. Additional Requirements are specified elsewhere including, but not necessarily limited to, General Conditions, Supplementary Conditions, and Division 1.

1.3 DESIGN REQUIREMENTS

The Temporary Construction Dewatering System shall be designed by a Professional Engineer registered in the State of Maine (the “Design Engineer”) who is experienced in the design of Temporary Construction Dewatering Systems for subsurface construction operations.

B. The Temporary Construction Dewatering System shall be of sufficient size and capacity necessary to lower and maintain the ground water table to an elevation at least two feet below the lowest foundation subgrade, or bottom of pipe trench, to allow material to be excavated in a dry condition, including depressurizing the soil stratum beneath the excavation subgrade. Materials to be removed shall be sufficiently dry to permit excavation to grades shown on the Contract Drawings and to stabilize the excavation slopes where temporary excavation support systems are not required. Operate the dewatering system continuously until backfill work has been completed.

C. Control of surface and subsurface water is part of the Temporary Construction Dewatering System requirements. Maintain adequate control so that:

1. The stability of excavated and constructed slopes are not adversely affected by saturated soil, including water entering the prepared subbase and subgrades where underlying materials are not free draining or are subject to swelling or freeze-thaw action.
2. Erosion is controlled.
3. Flooding of excavations or damage to structures does not occur.
4. Surface water drains away from excavations.
5. Excavations are protected from becoming wet from surface water and ensure excavations are dry before additional work is undertaken.

6. Prevent loss of fines, seepage, boils, quick conditions or softening of foundation strata.
7. The stability of the sides and bottom of excavations are sustained during excavations. Construction operations shall be performed to dry and stable soils.
8. Any existing dewatering wells that can affect dewatering and excavation shall be sealed below the excavation subgrade.

D. The design shall include an assessment of how the dewatering operations will affect the stability of all adjacent structures.

E. Contractor is responsible to perform additional geotechnical investigations as deemed necessary to facilitate the design of the Temporary Construction Dewatering System and prevent damage to adjacent buildings, roads, structures, utilities and other facilities.

1.4 QUALITY ASSURANCE

A. The Temporary Construction Dewatering System shall be installed, operated and monitored by the Contractor or a specialty subcontractor specializing in and having experience installing and operating dewatering systems in similar subsurface conditions for at least 5 years.

B. Well drillers, if required, shall be licensed in the State of Maine.

1.5 SUBMITTALS

A. Provide submittals in accordance with the Specification.

B. Provide a Temporary Construction Dewatering System Plan prepared by a Professional Engineer (as specified above) at least 30 days prior to beginning operations. This submittal shall include:

1. Qualifications of the Temporary Construction Dewatering System Design Engineer and qualifications of the Contractor or specialty subcontractor installing and operating the system.
2. Signed and sealed design calculations confirming the adequacy of the proposed system to manage groundwater, to eliminate pumping of fines and to prevent damage to adjacent buildings, roads, structures, utilities and other facilities.
3. Signed and sealed, dimensioned layout drawings showing the arrangement, location, depth and size of wells, wellpoints, headers, sumps, ditches; size and location of discharge lines; pumps; standby pumps; standby power equipment; effluent treatment components, effluent disposal location, and observation wells/ piezometers.
4. Detailed written description of dewatering methods to be employed to convey the water from site to adequate disposal, including operations, maintenance and control requirements.
5. Estimated average, minimum and maximum pumping rates (total).
6. Capacity and number of standby pumping equipment.
7. Capacity and number of standby power equipment.
8. Treatment tankage and discharge locations.
9. Technical data on the well screens, filter materials and gradations to demonstrate adequacy of the proposed systems to prevent migration of fines.
10. Structure Monitoring Plan, if required.
11. Pre-Construction and Post-Construction Survey, if required.
12. Effluent monitoring provisions and laboratory testing methods, including sample monitoring log (flow, TSS, etc.).
13. System removal requirements.
14. Written approval from the Maine Department of Environmental Protection for disposal of the treated water.

C. The Temporary Construction Dewatering System submittal shall be provided concurrently with and coordinated with the submittals required by Section 02156 (Temporary Excavation Support Systems).

D. Submit water monitoring results at the frequency required by the permitting authority.

E. Submit structure monitoring results, if required, at the frequency specified herein.

F. Submittal review with no exceptions taken of the Temporary Construction Dewatering System Plan shall not in any way relieve the Contractor from full responsibility for the complete and adequate design, installation and performance of the dewatering system and shall not relieve the Contractor of sole responsibility for the dewatering system as necessary to prevent damage and settlement to adjacent buildings, roads, structures, utilities and other facilities adjacent to the excavations and for the safety of people working within the excavated areas.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment used in the Temporary Construction Dewatering System shall adhere to accepted industry standards.

B. Backup equipment for the Temporary Construction Dewatering System shall be identical to the primary equipment, shall be immediately available and in operating condition at all times.

C. Pipes and Well Screens: Schedule 40 PVC or stronger.

D. Sand: Clean, single-size filter sand having an effective size (D10) of 0.3 to 0.5 mm with a fineness modulus of less than 4 and with no more than 4% passing a 100 sieve.

E. Grout: Cement-bentonite grout of adequate mix proportion and consistency. Seals shall consist of bentonite pellets.

F. Pumps, meters, hoses and controls shall be suitable for the intended purpose and application.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. General:

1. Prior to any excavation below the ground water table, place the Temporary Construction Dewatering System into continuous operation (24 hours per day, 7 days per week) to lower the water table as required until utilities and structures have been satisfactorily constructed, which includes the placement of backfill materials and dewatering is no longer required.
2. The Contractor shall coordinate the dewatering system operation with existing and proposed conditions.
3. The Temporary Construction Dewatering System Design Engineer and the Contractor shall modify the dewatering system and methods as required by actual field conditions encountered during construction, at no additional cost to the Owner. Any component of the dewatering system that malfunctions or is damaged during its operation shall be promptly repaired or replaced by the Contractor at no additional cost to the Owner.
4. Surface areas adjacent to the excavation shall be graded and/or curbed to prevent flow of surface water into the excavation.
5. The Contractor shall install observation wells / piezometers prior to beginning excavation work.
6. The Contractor shall notify the Engineer 7 days prior to the dewatering system start-up.

7. Keep work areas dewatered until all construction of new structures, pipes, and appurtenances have been substantially completed to the extent that they will not be damaged by water.
8. Thoroughly brace, or otherwise protect against flotation, all pipelines and structures which are not stable until final grades and ground cover is established.
9. Maintain standby, or backup, equipment and power supply throughout the duration of the dewatering operations.
10. Prevent soil particles from entering the discharge points.

B. Disposal of Water:

1. Dispose of water pumped or drained from the construction site in a suitable manner to avoid siltation of adjacent drainage structures and piping, wetlands or water bodies, injury to public health, damage to public and private property, and damage to the work completed or in progress.
2. Provide suitable temporary channels for water that may flow along or across the construction site.
3. Provide treatment as necessary to prevent discharge of contaminated ground water caused by Contractor's operations or any contaminated ground water that may pass through the Temporary Construction Dewatering System.
4. Contractor must obtain all necessary regulatory approvals for the disposal of dewatering flows. These may include, among others, approval by the USEPA under the National Pollutant Discharge Elimination System (NPDES) program for construction activities.

C. Temporary Underdrains:

1. When necessary, temporary underdrains may be placed in excavations.
2. Underdrain pipe shall be perforated corrugated metal, polyethylene or P.V.C. pipe.
3. Surround the underdrain completely and fill the space between the underdrain and the pipe or structure with free draining material.

D. Excavation Sump Pumping:

1. When necessary, and where appropriate to the geotechnical conditions encountered, excavations may be over excavated 12 to 24-inches and filled with screened stone to allow sump pumping of groundwater. Immediately cease operations if boils, loss of fines, quick conditions, softening of the ground or instability of slopes occur.
2. The system shall be installed with suitable screens and filters so that pumping of fines does not occur.

E. Well and Wellpoint System:

1. If necessary, dewater the excavations and trenches with an efficient well or wellpoint system to drain the soil and prevent saturated soil from flowing into the excavated wells and area.
2. Wellpoint and well systems shall be of the type designed for dewatering work and shall be installed with suitable screens and filters so that pumping of fines does not occur.
3. Pumping units shall be capable of maintaining sufficient suction to handle large volumes of air and water at the same time.

F. Removal

1. Remove all equipment after the permanent installations are complete.
2. All wells and piezometers shall be properly abandoned at the completion of the work, unless otherwise directed by the Temporary Construction Dewatering System Design Engineer, in accordance with requirements or guidelines in project location.

3.2 PRE-TREATMENT

A. The Contractor shall provide a settling tank (or tanks) to provide pre-treatment of groundwater prior to discharge. Tanks shall be sized to provide 60-minute hydraulic retention time at the anticipated maximum sustained pumping rate. Tanks shall have an underflow baffle to collect any floatables and shall have a final overflow weir to allow for flow measurement and sample collection. The effluent weir shall be sized to allow for accurate flow measurement based on the anticipated pumping rates.

B. Routine inspection of the settling tanks shall be carried out daily, with records maintained.

C. Settling tanks shall be cleaned frequently to prevent excess deposition of solids which could overflow from the tank.

D. Conduct effluent sampling requirements per the requirements of the permitting authority which is receiving the pre-treated dewatering system effluent.

3.3 MONITORING

A. General:

1. Contractor shall monitor the performance of the dewatering system and the groundwater level achieved throughout construction.

2. Contractor shall monitor the effluent quality from the treatment system as required by the permitting authority.

3. The Temporary Construction Dewatering System Design Engineer shall visit the site during the monitoring program at periodic intervals.

4. General Contractor shall maintain dewatering activities to avoid damage to and settlement of adjacent buildings, roads, structures, utilities and other facilities.
Contractor shall monitor the adjacent grade, buildings, roads, structures, utilities and other facilities throughout construction. Monitoring shall include the following at a minimum:

a. Pre-Installation Structure Elevation Survey. Survey of each structure prior to installation of dewatering system. Survey shall include digital photos of each structure and written description of existing deficiencies:

i. Structure Monitoring. Conduct structure monitoring as outlined below for the duration of the Temporary Construction Dewatering System operations, as outlined below:

iii. All monitoring points will be set at the tops of concrete (or structural steel) and will be selected by the Engineer during construction.

iv. A minimum of 3 monitoring points for each structure will be established. All elevations shall be to the nearest 0.001 foot.

v. Baseline elevations shall be established for each structure before dewatering activities commence. These elevations will be used for comparison to future elevations to determine if and what magnitude of movement has occurred.

vi. Elevations shall be taken at the same monitoring points for each structure at the same time on a weekly basis.

vii. Upon either detecting an incremental settlement of 0.005 feet, a total cumulative settlement of 0.01 feet or visible damage to any of the structures, Contractor shall proceed to the Corrective Actions specified below.

b. Post-Installation Structure Survey. Survey after operation of dewatering system is discontinued.

3.4 CORRECTIVE ACTION

A. No movement of or damage to adjacent buildings, roads, structures, utilities and other

facilities shall be allowed.

B. If dewatering requirements are not satisfied due to inadequacy or failure of the dewatering system (loosening of the foundation strata, or instability of slopes, or damage to foundations or structures), the Contractor shall stop work and consult with the Design Engineer and resubmit a revised Temporary Construction Dewatering System design submittal. The revised plan shall indicate why the system revisions are needed and indicated what change will be made to address the issues. Contractor shall perform work necessary for reinstatement of foundation soil and damaged structure resulting from such inadequacy or failure by Contractor, at no additional cost to the Owner.

C. Damage to existing structures shall be repaired at no additional cost to the Owner.

CERTIFICATE OF DESIGN

RE: Contract between
OWNER: _____
(Name)
and
CONTRACTOR: _____
(Name)
on
CONTRACT: _____
(Title)
_____
(Number) (Date)

The undersigned hereby certify that the engineer listed below (the "Design Engineer"):

1. Is licensed or registered to perform professional engineering work in the State of _____ (location of Project);
2. Is qualified by education and training to design the Temporary Construction Dewatering System specified in Section 02140 of the subject Contract;
3. Has previously successfully designed comparable groundwater dewatering systems;
4. Has prepared the design in full compliance with the requirements of subject contract, including all applicable laws, regulations, rules, and codes.
5. Has reviewed and coordinated the design of the Temporary Construction Dewatering System with the Temporary Excavation Support System design (specified in Section 02156); and
6. Will inspect and supervise installation of the Temporary Construction Dewatering System and will monitor the in-place system to confirm that the system is installed and functions in accordance with the design.

CONTRACTOR	DESIGN ENGINEER
By: _____	By: _____
(Signature)	(Signature)
_____	_____
(Name)	(Name)
_____	_____
(Title)	(Engineering Discipline)
_____	_____
(Date)	(Date)

END OF SECTION

SECTION 31 25 00
EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. The work under this section shall include provision of all labor, equipment, materials and maintenance of temporary erosion control devices, as specified herein, as shown on the Drawings and as directed by the Engineer.
2. Erosion control measures shall be provided as necessary to correct conditions that develop prior to the completion of permanent erosion control devices, or as required to control erosion that occurs during normal construction operations.
3. Construction operations shall comply with all federal, state and local regulations pertaining to erosion control.
4. After awarding of or after being awarded the Contract, prior to commencement of construction activities, the Contractor will meet with the Engineer to discuss erosion control requirements and develop a mutual understanding relative to details of erosion control.

B. Related Work Specified Elsewhere:

1. Site work is specified in appropriate sections of this Division.

C. Design Criteria:

1. Conduct all construction in a manner and sequence that causes the least practical disturbance of the physical environment.
2. Stabilize disturbed earth surfaces in the shortest time and employ such temporary erosion control devices, as may be necessary, until such time as adequate soil stabilization has been achieved.

1.2 SUBMITTALS

A. The Contractor shall furnish the Engineer, in writing, his work plan giving proposed locations for storage of topsoil and excavated material, before beginning construction. A schedule of work shall accompany the work plan. Acceptance of this plan will not relieve the Contractor of his responsibility for completion of the work as specified.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Baled Hay:

1. At least 14" by 18" by 30" securely tied to form a firm bale, staked as necessary to hold the bale in place.

B. Sand Bags:

1. Heavy cloth bags of approximately one cubic foot capacity filled with sand or gravel.

C. Mulches:

2. Loose hay, straw, peat moss, wood chips, bark mulch, crushed stone, wood excelsior, or wood fiber cellulose.

3. Type and use shall be as specified by the "Maine Erosion and Sedimentation Control Best Management Practices" prepared by the Maine DEP, herein after referred to as the BMP.

B. Mats and Nettings:

1. Twisted Craft paper, yarn, jute, excelsior wood fiber mats, glass fiber and plastic film.
2. Type and use shall be as specified in the BMP.

C. Permanent Seed:

1. Conservation mix appropriate to the predominant soil conditions as specified in the BMP and subject to approval by the Engineer.

D. Temporary Seeding:

1. Use species appropriate for soil conditions and season as specified in the BMP and subject to approval by the Engineer.

E. Water:

1. The Contractor shall provide water and equipment to control dust, as directed by the Engineer.

F. Silt Fence:

1. Silt Fence shall be one of the commercially available brands, meeting the following requirements:

Geotextile Mechanical Property	Test Method	Minimum Permissible Value
Grab Tensile Strength (both directions)	ASTM D-4632	124 pounds
Puncture Strength	ASTM D-4833	60 pounds
Apparent Opening Size	ASTM D-4751	#30
Flow Rate	ASTM D-4491	8 gal/min/ft^2

2.2 CONSTRUCTION REQUIREMENTS

A. Temporary Erosion Checks:

1. Temporary erosion checks shall be constructed in ditches and other locations as necessary.
2. Baled hay, sand bags or siltation fence may be used in an arrangement to fit local conditions.

B. Temporary Berms:

1. Temporary barriers shall be constructed along the toe of embankments when necessary to prevent erosion and sedimentation.

C. Temporary Seeding:
Areas to remain exposed for a time exceeding 3 weeks shall receive temporary seeding as indicated below:

Season	Seed	Rate
Summer (5/15 - 8/15)	Sudangrass	40 lbs/acre
Late Summer/Early Fall (8/15 - 9/15)	Oats Annual Ryegrass	80 lbs/acre
Fall (9/15 - 10/1)	Winter Rye	40 lbs/acre
Winter (10/1 - 4/1	Mulch w/Dormant Seed	112 lbs/acre
Spring (4/1 - 7/1)	Oats	80 lbs/acre*
	Annual Ryegrass	80 lbs/acre 40 lbs/acre

* seed rate only

D. Silt Fence shall be supported by posts and installed per the manufacturer's recommendations.

E. Mulch All Areas Receiving Seeding:

1. Use either wood cellulose fiber mulch (750 lbs/acre); or straw mulch with chemical tack (as per manufacturer's specifications). Wetting for small areas may be permitted. Biodegradable netting is recommended in areas to be exposed to drainage flow.

F. Erosion control matting for slopes and ditches shall be anchored with pegs and/or staples per manufacturer's recommendations. Contractor shall provide matting along the flowline of all ditches and swales having a longitudinal slope in excess of 0.01 ft/ft, and on all slopes in excess of 3(H) to 1(V).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Temporary Erosion Checks:

1. Temporary erosion checks shall be constructed in ditches and at other locations designated by the Engineer. The Engineer may modify the Contractor's arrangement of silt fences, bales and bags to fit local conditions.
2. Baled hay, silt fences, or sandbags, or some combination, may be used in other areas, as necessary, to inhibit soil erosion.
3. Siltation fence shall be located and installed as shown on plans or as required to comply with all Federal, State and Local Regulations.
4. Sedimentation ponds shall be sited and constructed to the grades and dimensions as shown on the Drawings and will include drainage pipe and an emergency spillway.

B. Erosion control matting for slopes and ditches shall be installed where indicated on the Drawings and as required to stabilize the soil until permanent vegetative stabilization is established.

C. Maintenance:

1. Erosion control features shall be installed prior to excavation wherever appropriate. Temporary erosion control features shall remain in place and shall be maintained until a satisfactory growth of grass is established. The Contractor shall be

responsible for maintaining erosion control features throughout the life of the construction contract. Maintenance will include periodic inspections by the Owner or Engineer for effectiveness of location, installation and condition with corrective action taken by the Contractor, as appropriate.

D. Removing and Disposing of Materials:

1. When no longer needed, material and devices for temporary erosion control shall be removed and disposed of upon approval by Engineer.
2. When removed, such devices may be reused in other locations, provided they are in good condition and suitable to perform the erosion control for which they are intended.
3. When dispersed over adjacent areas, the material shall be scattered to the extent that it causes no unsightly conditions nor creates future maintenance problems.
4. Sedimentation basins, if no longer required, will be filled in, the pipe removed, the surface loamed and grass cover shall be established.

END OF SECTION

SECTION 31 41 00
SHORING AND BRACING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish, install and maintain sheeting and bracing (or other methods of excavation support and underpinning which the Contractor elects to use) as required to comply with all applicable State and Federal regulations including the Occupational Safety and Health Act.

B. Related Work Specified Elsewhere (When Applicable): Earthwork and dewatering are specified in the appropriate Sections in this Division.

1.2 DESIGN REQUIREMENTS

A. The Contractor shall be responsible for the design and construction of the excavation support structures. The excavation support structures (sheeting systems or other special excavation techniques) shall be properly designed by a Professional Engineer registered in the State in which the project in located, who practices in a discipline applicable to excavation work and shall have experience in the design of excavation support systems.

B. The excavation support system shall be designed and installed to limit the upward hydraulic gradient into the bottom of the excavation and to sustain all existing and expected loads and utilities, to prevent all movement to earth which could in any way cause injury to workmen, delay the work or endanger adjacent structures. If detrimental effects results from construction activities, the Contractor shall modify the design, revise construction procedures and/or take measures to mitigate and abate further movement at no cost to the Owner.

C. The internal lateral bracing shall be located so that the braces shall not pass through walls and/or slabs.

D. Prior to the installation of any portion of the temporary lateral support system, the Contractor shall furnish to the Owner precondition surveys documenting the existing conditions of the adjacent structures.

E. The use of existing structures to support the sheeting bracing or structural framing shall be prohibited.

1.3 SUBMITTALS

A. Submit attached certificate of design and complete layout drawings of the proposed excavation system, stamped and sealed by a Professional Engineer registered in the State in which the project is located. The Contractor shall have sole responsibility for design and construction of the excavation support system as necessary to prevent damage to adjacent structures, utilities, streets adjacent to excavations and for safety of persons working within the excavated areas.

PART 2 - PRODUCTS

2.1 MATERIAL

A. All materials shall conform to all applicable State and Federal regulations including the Occupational Safety and Health Act.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Perform preparatory work to discover, protect, maintain and restore utilities, foundations or other facilities located in close proximity of the proposed excavation lateral support system.

B. Conduct pre-excavation to remove obstructions along the alignment of the excavation lateral support system which will interfere with installation of the excavation lateral support system.

C. Install the excavation support system, including the installed wall and bracing system, outside the limits of the permanent structure. Construction tolerances (e.g., wall verticality) and lateral wall deflections as a result of excavation and other activities shall be considered in determining the plan location.

D. Excavation shall not proceed more than 2 ft. below the bracing level, anywhere within the excavation support limits, until the entire level of bracing is completely installed.

E. The first level of bracing shall be installed within 5 ft. of the ground surface prior to any excavation below this level.

3.2 INSTALLATION

A. Install sheeting in accordance with all applicable State and Federal regulations including the Occupational Safety and Health Act.

3.3 REMOVAL OF SHEETING

A. Remove all sheeting and bracing unless the removal may cause injury to adjacent structures and/or property.

B. The General Contractor shall be responsible for repairing all damage to existing structures caused by the removal of sheeting.

C. All backfill disturbed by the removal of the sheeting shall be re-compacted to its in-situ density.

D. Proceed with backfilling as specified in these Specifications. When the level of compacted backfill reaches the location of bracing and wales, remove these items from the trench or other excavation. When the level of the backfill reaches a point three feet below the existing ground grade, remove the sheeting by approved methods and equipment.

E. After removing the sheeting, complete backfilling in the usual manner.

CERTIFICATE OF DESIGN

RE: Contract between
OWNER: _____
(Name)
and
CONTRACTOR: _____
(Name)
on
CONTRACT: _____
(Title)
_____
(Number) (Date)

The undersigned hereby certify that the engineer listed below:

1. Is licensed or registered to perform professional engineering work in the state of _____;
(Location of Project)

2. Is qualified by education and training to design the _____
_____
specified in Section _____ of subject contract;

3. Has previously designed comparable excavation support systems;

4. Has prepared the design in full compliance with the requirements of subject contract, including all applicable laws, regulations, rules, and codes; and

5. Will inspect and supervise installation of the excavation support system and will monitor the in-place system to confirm that the system is installed and functions in accordance with the design.

CONTRACTOR	ENGINEER
By: _____	By: _____
(Signature)	(Signature)
_____	_____
(Name)	(Name)
_____	_____
(Title)	(Engineering Discipline)
_____	_____
(Date)	(Date)

END OF SECTION

SECTION 31 66 13.13

AGGREGATE PIER GROUND IMPROVEMENT

PART 1: GENERAL REQUIREMENTS

1.01 Summary

Work shall consist of designing, furnishing and installing Aggregate Pier (APs) ground improvement elements to support the foundations, slabs-on-grade and entrance slabs and as specified herein. AP elements shall be in a columnar-type configuration and shall be used for support of footing and slab-on-grade loads. AP elements shall be constructed by driving a hollow mandrel to the design depth and vertically ramming lifts of aggregate using a specially designed mandrel head and high-energy impact densification equipment to create the compacted aggregate piers.

1.02 Work Included

A. Provision of all equipment, material, labor, and supervision to design and install AP elements. Design shall rely on subsurface information presented in the project Geotechnical Report by S.W. Cole Engineering Inc. (S.W.COLE), dated April 3, 2026. Survey layout of AP elements, spoil removal (as required), footing excavations, and footing/slab subgrade preparation following AP installation is not included.

B. The AP design and installation shall adhere to all methods and standards described in this Specification.

C. Drawings and General Provisions of the Contract, including General and Supplemental Conditions, and Division 1 Specifications, apply to the work in this specification.

1.03 Approved Installers

A. The AP Installer (the Installer) shall be approved by the Owner's Geotechnical Engineer S.W.COLE at least two (2) weeks prior to bid opening. The Owner's Geotechnical Engineer is hereinafter referred to as "Geotechnical Engineer of Record (GER)".

B. Installers shall have a minimum of 3 years of experience with the installation of AP systems, completed at least 10 successful AP projects in New England, and completed at least 3 successful AP projects in similar ground conditions.

1.04 Reference Standards

A. Design

1. "Control of Settlement and Uplift of Structures Using Short Aggregate Piers," by Evert C. Lawton (Assoc. Prof., Dept. of Civil Eng., Univ. of Utah), Nathaniel S. Fox (President, Geopier Foundation Co., Inc.), and Richard L. Handy (Distinguished Prof. Emeritus, Iowa State Univ., Dept. of Civil Eng.), reprinted from *IN-SITU DEEP SOIL IMPROVEMENT, Proceedings of sessions sponsored by the Geotechnical Engineering Division/ASCE in conjunction with the ASCE National Convention held October 9-13, 1994, Atlanta, Georgia*.

2. "Settlement of Structures Supported on Marginal or Inadequate Soils Stiffened with Short Aggregate Piers," by Evert C. Lawton and Nathaniel S. Fox. *Geotechnical Special Publication No. 40: Vertical and Horizontal Deformations of Foundations and Embankments,* ASCE, 2, 962-974.

3. "Technical Bulletin No. 12, Proper Load Testing Procedures to Verify Adequate Design of Geopier-Supported Foundation Systems," by Kord Wissmann and W. Lake Carter, Geopier Foundation Company, Inc. ©2015.

B. Modulus Testing

1. ASTM D 1143 - Pile Load Test Procedures
2. ASTM D 1194 - Spread Footing Load Test

C. Materials and Inspection

1. ASTM D 1241 - Aggregate Quality
2. ASTM D 422 - Gradation of Soils

D. Where specifications and reference documents conflict, the AP Designer (the Designer) shall make the final determination of the applicable document.

1.05 Certifications and Submittals

A. Design Submittal - The Installer shall submit detailed design calculations and construction drawings prepared by the Designer for review and approval by the GER and the Structural Engineer of Record (SER). All plans shall be sealed by a Professional Engineer licensed in the State of Maine. The submittal shall include grout/cement mix design as applicable.

B. Professional Liability Insurance - The Designer shall have Errors and Omissions design insurance for the work. The insurance policy shall provide a minimum coverage of $3 million per occurrence. Insurance Certificates listing the Owner as Certificate Holder shall be included in the Design Submittal.

C. Modulus Test Reports – At least one modulus test(s) shall be performed on a non-production AP element as required by the Designer to verify the design assumptions. The Installer shall furnish the General Contractor (GC) a description of the installation equipment, installation records, complete test data, analysis of the test data and verification of the design parameter values based on the modulus test results. The report shall be prepared under direction of a Professional Engineer licensed in the State of Maine.

D. Daily AP Progress Reports - The Installer shall furnish a complete and accurate record of AP installation to the GC. The record shall indicate the element location, length, volume of aggregate used or number of lifts, densification forces during installation, and final elevations or depths of the base and top of elements. The record shall also indicate the type and size of the installation equipment used, and the type of aggregate used. The Installer shall immediately report any unusual conditions encountered during installation to the GC, the Designer, and the GER.

PART 2: MATERIALS

2.01 Aggregate

A. Aggregate used by the Installer for element construction shall be pre-approved by the Designer and shall demonstrate suitable performance during modulus testing. Typical aggregate consists of ASTM D-1241-68, No. 57 stone, or other graded aggregate approved by the Designer.

B. As necessary, clean, potable water or other suitable source shall be used to mix grout and increase aggregate moisture content where required. The GC shall provide such water to the Installer.

2.02 Grout/Cement

A. For grouted AP elements, grout shall consist of a homogeneous mixture of Type II Portland Cement and clean, potable water. Documentation for other additives shall be submitted for review.

B. For AP elements constructed with cement-treated aggregate (CTA), the CTA shall consist of a mixture of Type II Portland Cement and well-graded aggregate. The minimum cement content shall be 6% by weight.

PART 3: DESIGN REQUIREMENTS

3.01 AP Design

A. The AP system shall be designed in accordance with locally-accepted engineering practice and the methods described in Section 1 of these Specifications. The design life of the structure shall as stated in the Construction Documents.

B. The design shall meet the following performance criteria:

Footings

*Maximum Allowable Bearing Pressure for Footings Supported by AP Improved Soils	3,000 psf
Total Settlement for Footings:	≤ ½ -inch
Differential Settlement of Adjacent Footings:	≤ ½-inch

The Designer shall not assume or apply live load reductions unless specifically approved by the SER.

Slab-on-Grade

Total Settlement for Slab-on-Grade:	≤ ½-inch
Differential Settlement for Slab-on-Grade:	≤ ½-inch over 40 feet

C. A compacted granular Load Transfer Platform (LTP) shall be required below all footings and slabs to be supported by AP elements. The system shall be designed and perform to preclude punching of ground improvement elements into the LTP and preclude creating stress points distributed to the concrete footings leading to additional steel reinforcing with the cast-in-place concrete.

D. The Aggregate Pier elements shall be designed using an Aggregate Pier stiffness modulus to be verified by the results of the modulus testing described in Section 5.02.

3.02 Design Submittal

A. The Installer shall submit detailed design calculations, construction drawings, and shop drawings, (the Design Submittal), for review and approval at least 2 week(s) prior to the beginning of construction.

B. The design information shall include, but not be limited to, element configurations, materials, capacity and spacing, details and design of LTPs, bearing capacity analysis, settlement analyses, explanation of soil properties, element installation termination criteria, embedment depth into the bearing stratum, and all other relevant information.

C. With reference to paragraph 5.02.C, the design calculations shall quantify the AP element's maximum design stress on an individual element (which attracts more stress than the surrounding matrix soil) and is typically at least 3 to 5 times the allowable bearing pressure for footings.

D. A detailed explanation of the design parameters for settlement calculations shall be included in the Design Submittal.

E. The quality control test program for the AP system, meeting the design requirements described herein, shall be submitted.

F. All calculations and drawings shall be prepared and sealed by a Professional Engineer licensed in the State of Maine.

G. Submittals shall be submitted electronically only unless otherwise required by specific submittal instructions.

PART 4: EXECUTION

4.01 Approved Installation Procedures

The following sections provide general criteria for the construction of the AP elements. Unless otherwise approved by the Designer, the installation method used for AP element construction shall be that as used in the construction of the successful modulus test. Pre-augering shall be performed were necessary to reduce vibrations to existing buildings and infrastructure.

A. General

1. The Installer shall provide a qualified, full-time, solely-dedicated, quality control (QC) person on-site during the installation process. The QC person shall not be dual-purposed as crew laborer or operator. Automated, electronic, and/or remote

quality control will not be accepted as a replacement for the QC person. Refer to Section 5.01 for further detail.

2. At a minimum, AP elements must be designed and installed to fully-penetrate through the onsite fill soils and any buried organics and into underlying native sands. AP elements terminating within fill or organic soil layers will not be accepted, even if mandrel/probe resistance is demonstrated to be relatively high based on crowd testing or amperage build-up.

3. Vibration levels at existing buildings must be maintained below 2.0 inches per second or as otherwise recommended in the project specifications.

B. AP elements installed using displacement installation methods shall:

1. Displacement AP systems shall be constructed by advancing a specially designed mandrel with a minimum 15-ton static force augmented by dynamic vibration energy to the full design depth. The hollow-shaft mandrel, filled with aggregate, is incrementally raised, permitting the aggregate to be released into the cavity, and then lowered by vertically advancing and/or ramming to densify the aggregate and force it laterally into the adjacent soil. The cycle of raising and lowering the mandrel is repeated to the top of AP element elevation. The cycle distance shall be determined by the Designer.

2. Special high-energy impact densification apparatus shall be employed to vertically densify the AP elements during installation of each constructed lift.

3. Densification shall be performed using a mandrel/tamper. The mandrel/tamper foot is required to adequately increase the lateral earth pressure in the matrix soil during installation.

4. Downward crowd pressure shall be applied to the mandrel during installation.

5. Pre-augering may be used to help the mandrel penetrate through relatively dense soil areas and to reduce vibrations to existing buildings and infrastructure.

4.02 Plan Location and Elevation of AP Elements

The as-built center of each AP element shall be within 6 inches of the locations indicated on the plans.

4.03 Rejected AP Elements

AP elements installed beyond the maximum allowable tolerances shall be abandoned and replaced with new elements, unless the Designer approves the condition or provides other remedial measures. All material and labor required to replace rejected elements shall be provided at no additional cost to the Owner, unless the cause of rejection is due to an obstruction or mislocation.

PART 5: QUALITY CONTROL

5.01 Quality Control Technician

The Installer shall have a qualified, full-time, solely-dedicated, quality control (QC) person to verify and report all installation procedures. The Installer shall immediately report any unusual

conditions encountered during installation to the Designer, the GC, and to the GER. The quality control procedures shall include the preparation of AP Progress Reports completed during each day of installation containing the following information:

A. AP element location relative to building grid or project stationing.
B. Pre-auger diameter and soil conditions encountered during drilling (if required).
C. AP element length.
D. Planned and actual AP element elevations at the top and bottom of the element.
E. Average lift thickness of each AP element.
F. Volume of aggregate used in each element.
G. Documentation of any unusual conditions encountered.
H. Type and size of densification equipment used.

5.02 Single-Element AP Modulus Test(s)

A minimum of one single-element AP Modulus Test shall be performed at a location agreed upon by the Designer and the GER to verify or modify the AP design. The modulus tests shall be of the type and installed in a manner specified herein.

A. Modulus test procedures shall utilize appropriate portions of ASTM D 1143 and ASTM D 1194 and comply with Geopier Technical Bulletin No. 12.

B. The test plate/cap shall have the same diameter as the AP element design diameter and shall not extend beyond the edge of the AP element and over the matrix soil.

C. With reference to Geopier Technical Bulletin No. 12, the AP test element shall be tested to a load equal to the element area times at least 150 percent of the AP element's maximum design stress (not allowable bearing pressure for footings) to demonstrate that the element exhibits safe response during service loading. The AP element's maximum design stress is the maximum stress on the individual element (which attracts more stress than the surrounding matrix soil) and is typically at least 3 to 5 times the allowable bearing pressure for footings. Modulus tests that are proposed to be loaded as a function of allowable bearing pressure shall be performed per Paragraph 5.02.I.

D. A telltale shall be installed at the bottom of the test element so that bottom-of-element deflections may be determined. For ungrouted/uncemented AP elements, acceptable performance is indicated when the bottom of the element deflection is no more than 30% of the top of element deflection at the design stress level.

E. ASTM D-1143 general test procedures shall be used as a guide to establishing load increments, load increment duration, and load decrements. As a minimum, the following loading increments, decrements and duration shall be used.

Increment	Approximate Load (percent design)	Minimum Duration (min)	Maximum Duration (min)
Seat	< 9	0	N/A
1	17	15	60
2	33	15	60
3	50	15	60

4	67	15	60
5	83	15	60
6	100	15	60
7	117	60	120
8	133	15	60
9	150	15	60
10	100	N/A	N/A
11	66	N/A	N/A
12	33	N/A	N/A
13	0	N/A	N/A

F. With the exception of the load increment representing approximately 117% of the AP element maximum design stress, all load increments shall be held for a minimum of 15 minutes. Loads are then maintained until the rate of deflection reduces to 0.01 inch per hour or for the maximum of 1 hour, whichever occurs first.

G. Creep Test - The load increment that represents approximately 117% of the AP element maximum design stress shall be held for a minimum of 60? minutes. Loads are then maintained until the rate of deflection reduces to 0.01 inch per hour or for the maximum of 4 hours, whichever occurs first.

H. A seating load equal to 5 percent of the total load shall be applied to the loaded steel plate prior to application of load increments and prior to measurement of deflections to compensate for surficial disturbance.

I. Modulus tests that are proposed to be loaded as a function of allowable bearing pressure must consist of full-scale spread footing load tests that include a test footing supported by a least three AP elements and having an AP area-replacement ratio ($Area_{APs}/Area_{Footing}$) that is representative of the smallest area replacement ratio used in the AP design. The test spread footing shall be loaded to at least 200 percent of the allowable bearing pressure to demonstrate that the AP-supported footing exhibits safe response during service loading.

5.03 Bottom Stabilization Testing (BSTs) / Crowd Stabilization Testing (CSTs)

Bottom stabilization testing (BSTs) or Crowd stabilization testing (CSTs) shall be performed by the Quality Control Technician during the installation of the modulus test element. Additional testing as required by the Designer shall be performed on selected production AP elements to compare results with the modulus test element.

PART 6: OWNER'S QUALITY ASSURANCE

6.01 Owner's Independent Quality Assurance

The Installer shall provide full-time Quality Control monitoring of AP construction activities. The Owner is responsible for retaining the GER to provide Quality Assurance services.

6.02 Responsibilities of the Owner's Independent Quality Assurance

A. The GER shall monitor the modulus test element installation and testing. The Installer shall provide and install all dial indicators and other measuring devices.

B. The GER shall monitor the installation of AP elements to verify that the production installation practices are similar to those used during the installation of the modulus test element(s).

C. With reference to Paragraph 4.01.A.3, the GER shall monitor vibrations and immediately report to the Installer and General Contractor if specified tolerances are exceeded.

D. The GER shall report any discrepancies to the Installer and GC immediately.

E. The GER shall observe the excavation, compaction and placement of the foundations as described in Section 7.05.

PART 7: RESPONSIBILITIES OF THE GC

7.01 Site Preparation and Protection

A. The GC shall locate and protect underground and aboveground utilities and other structures from damage during installation of the AP elements.

B. Site grade for AP installation shall be within 2 feet of FFE. Ground elevations and bottom of footing elevations shall be provided to the Installer in sufficient detail to estimate installation depth elevations to within 3 inches.

C. The GC will provide site access to the Installer, after site preparation in the area has been completed. A flat and stable working pad subgrade shall be established and maintained by the GC to provide wet weather protection of the subgrade and to provide access for efficient operation of the AP installation. Preparation of a flat and stable working pad may include placement of crushed stone and geotextile fabric. Any excavation or backfilling that occurs for working pad preparation shall be in accordance with the Designer's submittal.

D. Prior to, during and following AP installation, the GC shall provide positive drainage to protect the site from wet weather and surface ponding of water.

E. If spoils are generated by AP installation, spoil removal from the AP work area in a timely manner to prevent interruption of AP installation is required.

7.02 Aggregate Pier Layout

The location of individual AP elements shall be marked in the field using flagged and numbered whiskers at locations shown on the drawings.

7.03 Excavations for Obstructions

A. Should any obstruction be encountered during AP installation, the GC shall be responsible for promptly removing such obstruction or the element shall be relocated if possible. Obstructions include, but are not limited to, boulders, timbers, concrete, granite blocks, utilities, rubble, etc., which shall prevent placing the elements to the required depth, or shall cause the AP element to drift from the required location.

B. Dense natural rock or weathered rock layers shall not be deemed obstructions, and AP elements may be terminated short of design lengths on such materials.

7.04 Utility Excavations

The GC shall coordinate all excavations made subsequent to AP installations so that excavations do not encroach on the elements as shown in the AP construction drawings. Protection of completed AP elements is the responsibility of the GC. In the event that excavations are required in close proximity to the installed AP elements, the GC shall contact the Designer immediately to develop construction solutions to minimize impacts on the installed AP elements.

7.05 Footing and Slab Subgrade Preparation

A. Excavation and subgrade preparation of all footing and slab subgrades shall be the responsibility of the GC and performed in conformance with the Project Specifications and AP design submittal.

B. Excavations will expose the tops of AP elements and shall be made in a workman-like manner that protects the subgrade until structural fill or concrete placement. Procedures and equipment shall be selected to avoid subgrade/AP element disturbance and exposure to water.

C. All excavations for footing bottoms supported by AP elements shall be prepared in the following manner by the GC. Recommended procedures for achieving these goals are to:

1. Limit over-excavation below the bottom of the footing to 3-inches (including disturbance from the teeth of the excavation equipment).

2. Compaction of surface soil and top of AP elements shall be prepared using a motorized impact compactor (“Wacker Packer,” “Jumping Jack,” or similar). Sled-type tamping devices shall only be used in granular soils and when approved by the Designer. Loose or soft surficial soil over the entire footing bottom shall be recompacted or removed, respectively. The surface of the AP elements shall be recompacted prior to completing footing bottom preparation.

3. Place footing concrete immediately after footing excavation is made and approved, preferably the same day as the excavation. Footing concrete must be placed on the same day if the footing is bearing on moisture-sensitive soils. If same day placement of footing concrete is not possible, open excavations shall be protected from surface water accumulation. A lean concrete mud-mat may be used to accomplish this. Other methods must be pre-approved by the Designer.

D. The following criteria shall apply, and a written inspection report by the GER/Testing Agency shall be furnished to the Installer to confirm:

1. That water has not been allowed to pond in the footing excavation at any time. Ponded water may soften the unconfined matrix soil between and around the AP elements, and may have detrimental effects on the supporting capability of the AP reinforced subgrade.

2. That all AP elements designed for each footing have been exposed in the footing excavation.

3. That the tops of AP elements exposed in each footing excavation have been inspected and recompacted as necessary with mechanical compaction equipment.

4. That no excavations or drilled shafts (elevator, etc) have been made after installation of AP elements within the excavation limits described in the AP construction drawings, without the written approval of the Installer or Designer.

E. Failure to provide the above inspection from the GER/Testing Agency, which is beyond the responsibility of the Installer, may void any written or implied warranty on the performance of the AP system.

PART 8: MINIMUM PERFORMANCE REQUIREMENTS

A. Base bid shall cover mobilization, modulus testing, preparation of AP plans and specifications, installation of AP elements, and demobilization, all as necessary to achieve the bearing pressures specified.

B. Excavation of any hazardous materials (if discovered) will be by others.

END OF SECTION

SECTION 32 13 16
CONCRETE PAVING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: This work shall consist of the construction of new cement concrete sidewalks and driveways in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the Drawings or established by the Engineer.

B. Related Work Specified Elsewhere: (When Applicable) Earthwork, aggregate base and subbase, bituminous concrete paving and granite curbs are specified in the appropriate sections in this Division.

1.2 RELATED DOCUMENTS

A. State of Maine Department of Transportation Standard Specifications for Highways and Bridges, latest edition, herein after referred to as MDOT Specifications.

1.3 QUALITY ASSURANCE

A. Materials: Use only materials furnished by a bulk cement concrete producer regularly engaged in the production of portland cement concrete.

B. Submittals: A certificate of compliance shall be furnished to the Engineer that the materials supplied comply with the specification requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The portland cement concrete shall conform to the requirements of AASHTO M85 Type II with a moderate heat of hydration and with the following exceptions:

1. The autoclave expansion shall be limited to a maximum of 0.20 percent.
2. There will be no requirements for tensile strength. Only one brand of cement shall be used on any one contract unless otherwise permitted, in writing, be the Engineer.

B. The welded wire fabric for reinforcement shall conform to the requirements of AASHTO M55-73, unless otherwise specified.

C. The premolded expansion joint material shall be non-extruding and resilient bituminous type and shall conform to the requirements of AASHTO M213.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavation shall be to the depth and width that will permit the installation and bracing of the forms. The foundation shall be shaped and compacted to a firm even surface conforming to the section shown on the plan. All soft and yielding material shall be removed and replaced with acceptable material.

3.2 FORMS

A. Forms shall be of wood or metal and shall extend for the full depth of the concrete. All forms shall be true, free from warp and of sufficient strength to resist the pressure of the concrete without springing. Bracing and staking of forms shall be such that the forms remain in both horizontal and vertical alignment until their removal.

3.3 PLACING CONCRETE

A. The foundation shall be thoroughly moistened immediately prior to placing the concrete. The proportioning, mixing and placing of the concrete shall be in accordance with good construction practices, as stated in the requirements of the MDOT specifications Section 502 - Structural Concrete.

3.4 FINISHING

A. The surface shall be finished to produce a broom like pattern.

B. No plastering of the surface with mortar will be permitted.

3.5 JOINTS

A. Joints shall be located as shown on the plans. Slabs shall be placed alternately and the joints coated with an approved bituminous material before placing the adjacent slab.

B. When a concrete sidewalk is constructed adjacent to a curb, building, retaining wall, light pole base or other fixed structure, a 1/4 inch thick premolded joint filler shall be used between the slab and the structure.

3.6 CURING

A. Concrete shall be cured for at least 72 hours. Curing shall be by moist burlap or mats, white pigmented curing compound or by other approved methods. During the curing period, all traffic, both pedestrian and vehicular, shall be excluded. Vehicular traffic shall be excluded for such additional time as may be directed.

END OF SECTION

SECTION 32 92 00
LOAMING & SEEDING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish, place, and test topsoil, seed, lime, and fertilizer where shown on the drawings and protect and maintain seeded areas disturbed by construction work, as directed by the Engineer.

1.2 REQUIREMENTS SPECIFIED ELSEWHERE

A. Additional Requirements are specified elsewhere including, but not necessarily limited to, General Conditions and Supplementary Conditions.

1.3 SUBMITTALS AND TESTING

A. Seed:

1. Furnish the Engineer with duplicate signed copies of a statement from the vendor, certifying that each container of seed delivered to the project site is fully labeled in accordance with the Federal Seed Act and is at least equal to the specification requirements.
2. This certification shall appear in, or with, all copies of invoices for the seed.
3. The certification shall include the guaranteed percentages of purity, weed content and germination of the seed, and also the net weight and date of shipment. No seed may be sown until the Contractor has submitted the certificates and certificates have been approved.
4. Each lot of seed shall be subject to sampling and testing, at the discretion of the Engineer, in accordance with the latest rules and regulations under the Federal Seed Act.

B. Topsoil:

1. Inform the Engineer, within 30 days after the award of the Contract, of the sources from which the topsoil is to be furnished.
2. Obtain representative soil samples, taken from several locations in the area under consideration for topsoil removal, to the full stripping depth.
3. Have soil samples tested by an independent soils testing laboratory, approved by the Engineer, at the Contractor's expense.
4. Have soil samples tested for physical properties and pH (or lime requirement), for organic matter, available phosphoric acid, and available potash, in accordance with standard practices of soil testing.
5. Approval, by the Engineer, to use topsoil for the work will be dependent upon the results of the soils tests.

C. Lime & Fertilizer:

1. Furnish the Engineer with duplicate copies of invoices for all lime and fertilizer used on the project showing the total minimum carbonates and minimum percentages of the material furnished that pass the 90 and 20 mesh sieves and the grade furnished.
2. Each lot of lime and fertilizer shall be subject to sampling and testing at the discretion of the Engineer.

3. Sampling and testing shall be in accordance with the official methods of the Association of Official Agricultural Chemists.
4. Upon completion of the project, a final check may be made comparing the total quantities of fertilizer and lime used to the total area seeded. If the minimum rates of application have not been met, the Engineer may require the Contractor to distribute additional quantities of these materials to meet the minimum rates.

1.4 DELIVERY, STORAGE & HANDLING

A. Seed:
1. Furnish all seed in sealed standard containers, unless exception is granted in writing by the Engineer.
2. Containers shall be labeled in accordance with the United States Department of Agriculture's rules and regulations under the Federal Seed Act in effect at the time of purchase.

B. Fertilizer:
1. Furnish all fertilizer in unopened original containers.
2. Containers shall be labeled with the manufacturer's statement of analysis.

1.5 JOB CONDITIONS

A. Topsoil: Do not place or spread topsoil when the subgrade is frozen, excessively wet or dry, or in any condition otherwise detrimental, in the opinion of the Engineer, to the proposed planting or to proper grading.

B. Seeding:
1. Planting Seasons: The recommended seeding time is from April 1 to September 15. The Contractor may seed at other times. Regardless of the time of seeding, the Contractor shall be responsible for each seeded area until it is accepted.
2. Weather Conditions:
a. Do not perform seeding work when weather conditions are such that beneficial results are not likely to be obtained, such as drought, excessive moisture, or high winds.
b. Stop the seeding work when, in the opinion of the Engineer, weather conditions are not favorable.
c. Resume the work only when, in the opinion of the Engineer, conditions become favorable, or when approved alternate or corrective measures and procedures are placed into effect.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Seed:
1. Provide the grass seed mixture approved by the Engineer, having the following composition:
a. Lawn Areas:
i. Kentucky 31 Fescue 25 percent
ii. Chewing Fescue 15 percent
iii. Creeping Red Fescue 15 percent
iv. Pennfine Perennial Rye 25 percent

v. Lynn Perennial Rye 10 percent
vi. Common Annual Rye 10 percent
vii. No weed seeds allowed

2. Do not use seed which has become wet, moldy, or otherwise damaged in transit or during storage.

B. Topsoil:

1. Fertile, friable, natural topsoil typical of the locality, without admixture of subsoil, refuse or other foreign materials and obtained from a well-drained site. Mixture of sand, silt, and clay particles in equal proportions.
2. Free of stumps, roots, heavy of stiff clay, stones larger than 1-inch in diameter, lumps, coarse sand, weeds, sticks, brush or other deleterious matter.
3. Not less than 4 percent nor more than 20 percent organic matter.
4. Topsoil depth shall be 4-inches, unless otherwise indicated.

C. Lime:

1. Provide lime which is ground limestone containing not less than 85% of total carbonate and of such fineness that 90% will pass a No. 20 sieve and 50% will pass a No. l00 sieve.
2. Coarser materials will be acceptable provided the specified rates of application are increased proportionately on the basis of quantities passing a No. l00 sieve. No additional payment will be made to the Contractor for the increased quantity.

D. Fertilizer:

1. Provide a commercial fertilizer approved by the Engineer.
2. Provide fertilizer containing the following minimum percentage of nutrients by weight:
l0% Available phosphoric acid
l0% Available potash
l0% Available nitrogen (75% of the nitrogen shall be organic)

PART 3 - EXECUTION

3.1 PREPARATION

A. Equipment:

1. Provide all equipment necessary for the proper preparation of the ground surface and for the handling and placing of all required materials.
2. Demonstrate to the Engineer that the equipment will apply materials at the specified rates.

B. Soil: Perform the following work prior to the application of lime, fertilizer or seed.

1. Scarify the subgrade to a depth of 2 inches to allow the bonding of the topsoil with the subsoil.
2. Apply topsoil to a depth of 4 inches or as directed on areas to be seeded.
3. Trim and rake the topsoil to true grades free from unsightly variations, humps, ridges or depressions.
4. Remove all objectionable material and form a finely pulverized seed bed.

3.2 PERFORMANCE

A. Grading:
   1. Grade the areas to be seeded as shown on the Drawings or as directed by the Engineer.
   2. Leave all surfaces in even and properly compacted condition.
   3. Maintain grades on the areas to be seeded in true and even conditions, including any necessary repairs to previously graded areas.

B. Placing Topsoil:
   1. Uniformly distribute and evenly spread topsoil on the designated areas.
   2. Spread the topsoil in such a manner that planting work can be performed with little additional soil preparation or tillage.
   3. Correct any irregularities in the surface resulting from topsoiling or other operations to prevent the formation of depressions where water may stand.
   4. Thoroughly till the topsoil to a depth of at least 3 inches by plowing, harrowing, or other approved method until the condition of the soil is acceptable to the Engineer. The surface shall be cleared of all debris and or stones one inch or more in diameter.

C. Placing Fertilizer:
   1. Distribute fertilizer uniformly at a rate determined by the soils test over the areas to be seeded.
   2. Incorporate fertilizer into the soil to a depth of at least 3 inches by discing, harrowing, or other methods acceptable to the Engineer.
   3. The incorporation of fertilizer may be a part of the tillage operation specified above.
   4. Distribution by means of an approved seed drill equipped to sow seed and distribute fertilizer at the same time will be acceptable.

D. Placing Lime:
   1. Uniformly distribute lime immediately following or simultaneously with the incorporation of fertilizer.
   2. Distribute lime at a rate determined from the pH test, to a depth of at least 3 inches by discing, harrowing, or other methods acceptable to the Engineer.

E. Seeding:
   1. Fine rake and level out any undulations or irregularities in the surface resulting from tillage, fertilizing, liming or other operations before starting seeding operations.
   2. Hydroseeding:
      a. Hydroseeding may be performed where approved and with equipment approved by the Engineer.
      b. Sow the seed over designated areas at a minimum rate of 5 pounds per 1000 square feet.
      c. Seed and fertilizing materials shall be kept thoroughly agitated in order to maintain a uniform suspension within the tank of the hydroseeder.
      d. The spraying equipment must be designed and operated to distribute seed and fertilizing materials evenly and uniformly on the designated areas at the required rates.

3. Drill Seeding:
   a. Drill seeding may be performed with approved equipment having drills not more than 2 inches apart.
   b. Sow the seed uniformly over the designated areas to a depth of l/2 inch and at a rate of 5 pounds per l,000 square feet.
4. Broadcast Seeding:
   a. Broadcast seeding may be performed by equipment approved by the Engineer.
   b. Sow the seed uniformly over the designated areas at a rate of 5 pounds per l,000 square feet.
   c. Sow half the seed with the equipment moving in one direction and the remainder of the seed with the equipment moving at right angles to the first sowing.
   d. Cover the seed to an average depth of l/2 inch by means of a brush harrow, spike-tooth harrow, chain harrow, cultipacker, or other approved devices.
   e. Do not perform broadcast seeding work during windy weather.

F. Compacting:
1. Seeded areas must be raked lightly after sowing unless seeding is to be directly followed by application of an approved mulch.
2. Compact the entire area immediately after the seeding operations have been completed.
3. Compact by means of a cultipacker, roller, or other equipment approved by the Engineer weighing 60 to 90 pounds per linear foot of roller.
4. If the soil is of such type that a smooth or corrugated roller cannot be operated satisfactorily, use a pneumatic roller (not wobbly wheel) that has tires of sufficient size to obtain complete coverage of the soil.
5. When using a cultipacker or similar equipment, perform the final rolling at right angles to the prevailing slopes to prevent water erosion, or at right angles to the prevailing wind to prevent dust.

G. Mulching for Permanent Seeding:

1. Apply mulch at the specified rate for the given type and as specified by the “Maine Erosion and Sedimentation Control Best Management Practices” prepared by the Maine DEP.
2. Erosion Control Mix must contain some soil.
3. Hydraulic mulches, such as paper mulch and cellulose fiber, can include seeds, fertilizer, or soil binders.

Maine	
Mulch Type	**Rate**
Straw	2 bales (70-90lbs)/1,000 SF
Erosion Control Mix	<3:1 Slope: 2 inches min. >3:1 Slope: 4 inches min.
Paper Mulch	5 lbs/1,000 SF
Cellulose Fiber	40 lbs/1,000 SF
Erosion Control Blankets	Per manufacturer’s instructions
Wood Chips and Bark Mulch	3 inches min.

4. Apply mulch at the specified rate for the given type and as specified by the "New Hampshire Stormwater Manual, Volume 3: Erosion and Sediment Controls During Construction" prepared by the NHDES and Comprehensive Environmental Inc.

New Hampshire	
Mulch Type	**Rate**
Straw	2 bales, (70-90lbs)/1,000 SF
Wood Chips or Bark Erosion Control Mix	2-6 inches, (460-920) lbs/1,000 SF <15% Slope: 2 inches thick min. >15% Slope: 4 inches thick min.
Erosion Control Blankets	Per manufacturer's instructions
Wood Fiber Mulch	500 lbs/acre

3.3 PROTECTION & MAINTENANCE

A. Protection:

1. Protect the seeded area against traffic or other use.
2. Erect barricades and place warning signs as needed.

B. Maintenance:

1. At the time of the first cutting, set mower blades two inches high. All lawns shall receive at least two mowings before acceptance. Coordinate schedule for mowing with Engineer.
2. Maintenance shall also include all temporary protection fences, barriers and signs and all other work incidental to proper maintenance.
3. Maintain grass areas until a full stand of grass is indicated, which will be a minimum of 45 days after all seeding work is completed, and shall not necessarily related to Substantial Completion of the General Contract.
4. Protection and maintenance of grass areas shall consist of watering, weeding, cutting, repair of any erosion and reseeding as necessary to establish a uniform stand for the specified grasses, and shall continue until Acceptance by the Engineer of the work of this section. It shall also include the furnishing and applying of such pesticides as are necessary to keep grass areas free of insects and disease. All pesticides shall be approved by Engineer prior to use.

3.4 ACCEPTANCE

A. At final acceptance of the project all areas shall have a close stand of grass with no weeds present and no bare spots greater than three inches (3") in diameter over greater than five percent (5%) of the overall seeded area.

END OF SECTION

SECTION 33 05 05
RIGID BOARD INSULATION FOR PIPE IN TRENCHES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Provide and install rigid board insulation in trenches over or between piping, as shown on the Drawings and as specified herein.

1.2 REQUIREMENTS SPECIFIED ELSEWHERE

A. Additional Requirements are specified elsewhere including, but not necessarily limited to, General Conditions, Supplementary Conditions, and Division 1.

1.3 REFERENCES

A. ASTM C272 - Test Method for Water Absorption of Core Materials for Structural Sandwich Construction.

B. ASTM C518 - Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter.

C. ASTM D1621 - Test Method for Compressive Properties of Rigid Cellular Plastics.

1.4 SUBMITTALS

A. Submit shop drawings, product data and manufacturer’s written installation instruction in accordance with the applicable section of Division 1 and the General Conditions of the Construction Contract.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to project site in manufacturer's original unopened packaging.

B. Identify contents, manufacture, brand name, thermal values, and applicable standards.

C. Store materials in area protected from weather, and moisture.

D. Remove damaged materials from site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Rigid Pipe Insulation

1. Dow Chemical Company – Styrofoam Highload 40
2. Certifoam 40
3. Or equivalent

2.2 RIGID PIPE INSULATION

A. Insulation: Closed cell polystyrene foam board

1. Standard Two Foot Width.
2. Aged "R" Value - "R" = 5.0 per inch, ASTM C518.
3. Water Absorption - 0.1 percent, ASTM C272.

4. Water Vapor Permeance - 1.0 perm (max) ASTM E96
5. Compressive Strength - 40 pounds per square inch, ASTM D1621.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lay rigid board insulation in trenches over or between piping where depth of pipe cover is than that required on the Drawings. Install rigid board insulation as shown on the Drawings.

END OF SECTION

SECTION 33 05 20
UTILITY TRENCH EXCAVATION - EARTH

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Trench excavation work in earth includes the removal of sand, gravel, existing sewers and manholes, ashes, loam, clay, swamp muck, trolley tracks, soft or disintegrated rock or hard pan existing sewers and manholes which can be removed with a backhoe, or a combination of such materials, and boulders measuring less than two cubic yards for the installation of pipes and appurtenant structures.
2. All trench excavation shall be classed as earth or ledge.

B. Related Work - Specified Elsewhere:

1. Traffic regulation is specified in Division 00.
2. Clearing, removal and replacement of paving, trench excavation ledge, borrow and bedding, material, manholes, and catch basins, trench backfilling, compaction, control and testing, when applicable, are specified in the appropriate sections in this division.

1.2 JOB CONDITIONS

A. Utilities:

1. The locations of utilities shown on the plans are approximate as determined from physical evidence on or above the surface of the ground and from information supplied by the utilities. The Engineer in no way warranties that these locations are correct. It shall be the responsibility of the Contractor to determine the actual locations of any utilities within the project area.
2. Rules and regulations governing the respective utilities shall be observed in executing all work in this section. Active utilities shall be adequately protected from damage and removed or relocated only as indicated or specified. Inactive and abandoned utilities encountered in excavation and grading operations shall be removed, plugged or capped only with written authorization from the Utility Company. Report in writing to the Engineer, the locations of such abandoned utilities. Extreme care shall be taken when performing work in the vicinity of existing utility lines, utilizing hand excavation in such areas, as far as practicable. If, in the progress of excavation, any utility should become damaged and result in any damage to public or private property, the General Contractor shall restore to the original condition, at no additional cost to the Owner, anything which has been damaged or disturbed.

B. Existing Structures:

1. Perform excavation in such a manner that will prevent any possibility of undermining and disturbing the foundations of any existing structures and any work previously completed under this Contract.
2. Where existing buildings and other structures are in proximity to the proposed construction, exercise extreme caution and utilize sheeting, bracing, and whatever other precautionary measures, that may be required.

C. Repairing Damage:

1. Repair, or have repaired, all damage to existing utilities, structures, lawns, other public and private property which results from construction operations, at no additional expense to the Owner, to the complete satisfaction of the Engineer, the utility company, the property owners and the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The Contractor shall not have any right of property in any suitable materials taken from any excavation. Do not remove any such materials from the construction site without the approval of the Engineer. This provision shall in no way relieves the Contractor of his obligations to remove and dispose of any material determined by the Engineer to be unsuitable for backfilling.

B. Unsuitable Material:

1. If, in the opinion of the Engineer, the material encountered above the indicated grade, shown on the Drawings, for excavation is unsuitable material, remove the material to the widths and depths as directed by the Engineer. Replace this material as specified in the "Trench Backfilling, Compaction, Control and Testing" section of this division.
2. If, in the opinion of the Engineer, the material encountered at or below the indicated grade shown on the Drawings for excavation is unstable material, remove the material to the full width of the trench and to a minimum depth of twelve inches below the pipe. Replace this material with thoroughly compacted suitably screened gravel bedding material.
3. All excavated materials designated by the Engineer as unsuitable shall become the property of the Contractor and disposed of at locations acceptable to or designated by the Owner, at no additional cost to the Owner.

C. Embankment Material:

1. Obtain prior approval and instructions from the Engineer prior to undertaking the excavation for pipe placement of any fill material that has been in an embankment less than one year.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. General:

1. Unless otherwise specifically directed or permitted by the Engineer, begin excavation at the low end of sewer and storm lines and proceed upgrade.
2. Perform excavation for force mains and water mains in a logical sequence.

B. Amount of Excavation:

1. Trench width: As shown on the Drawings.
2. Trench depth: As shown on the Drawings.
3. Open Excavation:

a. The extent of open excavation shall be controlled by prevailing conditions.

b. Open excavation shall, at all times, be confined to the limits prescribed by the Engineer.

c. No trenches shall be left open during non-working hours unless adequate provisions are made to prevent injury to the work or persons. Appropriate barricades and warning devices shall be used to alert the public of hazardous areas.

4. Unauthorized Excavation:

a. Backfill to the specified grade, any excavation beyond the limits stated above and as shown on the Drawings (unless specifically ordered by the Engineer) with thoroughly compacted gravel borrow or screened gravel.

b. Backfilling unauthorized excavation shall be at no additional cost to the Owner.

C. Shoring and Bracing:

1. As the excavation progresses, install such shoring and bracing necessary to prevent caving and sliding and to meet the requirements of the state and OSHA safety standards.

END OF SECTION

SECTION 33 05 61

MANHOLES, COVERS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Construct manholes, covers, frames, brick masonry, inverts and apply dampproofing in conformance with the dimensions, elevations, and locations shown on the Drawings and as specified herein.

1.2 REQUIREMENTS SPECIFIED ELSEWHERE

A. Additional Requirements are specified elsewhere including, but not necessarily limited to, General Conditions and Supplementary Conditions.

1.3 QUALITY ASSURANCE

A. Precast Manhole Base, Barrel and Top Sections:

1. Conform to ASTM C478 latest edition except as modified herein, and on the Drawings.
2. Average strength of 5,000 psi at 28 days.
3. Testing:
    a. Determine concrete strength by tests on 6-inch by 12-inch vibrated test cylinders cured in the same manner as the bases, barrels and tops. NTS: For structures 6’ in diameter or greater – delete if not applicable.
    b. Have tests conducted at the manufacturer's plant or at a testing laboratory approved by the Engineer.
    c. Have not less than 2 tests made for each 100 vertical feet of precast manhole sections. Testing not required for projects with less than 100 vertical feet of precast structures. Test aggregate in accordance with ASTM C1293. Aggregate having an expansion less than 0.04% at 1-year is acceptable for use.

B. Manhole Steps:
1. Conform to ASTM C47 latest edition for load carrying capacity and pull out resistance.
2. Acceptable Manufacturers:
    a. Parson Environmental Products, Inc.
    b. M. A. Industries, Inc.
    c. Or equal

C. Frames and Covers:
1. Acceptable Manufacturers:
    a. EJ Castings
    b. Neenah Foundry Company.
    c. Or equal

D. Exterior Chimney Wrap/Seal:
1. Acceptable Manufacturers:
    a. Sealing Systems, Inc. Infi-Shield Uni-Band
    b. Or equal

E. Masonry:
1. Brick: Shall comply with the ASTM Standard Specifications for Sewer Brick (made from clay or shale), Designation C32, for Grade SS, hard brick.
2. Cement: ASTM C150, C595 Type IL.
3. Hydrated Lime: ASTM C207
4. Sand: ASTM C33

F. Dampproofing:
1. Acceptable Manufacturers:
   a. Karnak #220 AF Fibered Emulsion Dampproofing, Karnak Corp., Clark, NJ.
   b. Master Seal 615Sealmastic Type II Emulsion
   c. Or equal.

G. Pipe connections shall conform to ASTM C923, "Standard Specifications for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals"
Grade rings for frame and cover adjustments shall be made from expanded polypropylene. Pro-Rings or equivalent.

I. Sealant between precast sections shall be butyl rubber sealant with a minimum diameter of 1-inch. Conseal SC-102, Kent Seal, RN 101 Ram Nek or equivalent.

1.4 SUBMITTALS

A. Submit shop drawings and manufacturer's literature in conformance with Section 01340 and the Standard General Conditions of the Construction Contract.

B. Precast Manhole Sections:
1. Submit concrete test results for review prior to delivery to the site.
2. Submit all accessories products for review.

1.5 WARRANTY

A. Contractor's one year warranty, as specified in Division 0, shall include but not be limited to:
1. Cracking, spalling or other surface and structural defects.
2. Separation of joints or misalignment of adjacent units due to faulty precast concrete sections.
3. Leakage through all joints between concrete sections due to faulty materials or improper installation.
Microbiologically induced corrosion.

B. The Contractor shall repair or replace all defective work at no additional cost to the Owner within warranty period.

PART 2 - PRODUCTS

2.1 PRECAST MANHOLE SECTIONS

A. Dimensions, shall be as shown on the Drawings:
1. Base & Riser Sections:
   a. Diameter: As shown on the Drawings.
   b. Length: As required.
   c. Wall Thickness: Not less than 5 inches.

d. Joints: Bell-and-spigot or tongue-and-groove formed on machine rings to ensure accurate joint surfaces.

2. Tops:
   a. Diameter: Eccentric cone type, 24 inches I.D. at top, match I.D. at bottom unless otherwise shown on the Drawings.
   b. Height: 4 feet.
   c. Wall thickness: Not less than 5 inches at the base, tapering to not less than 8 inches at the top.
   d. Joints: Bell-and-spigot or tongue-and-groove formed on machine rings to ensure accurate joint surfaces.
   e. Exterior face of cone sections shall not flare out beyond the vertical.
3. Flat Slab Tops:
   a. Location: Where shallow installations do not permit the use of a cone-type top and where indicated on the Drawings.
   b. Slab thickness: Not less than 6 inches.
   c. Constructed to support an H-20 wheel loading.

B. Aggregates:
1. The use of crushed hydraulic cement or recycled aggregate is prohibited.
2. Coarse aggregate shall consist of a well graded crushed stone or a washed gravel conforming to the requirements of ASTM C33/C33M.

C. Openings:
1. Provide openings in the risers to receive pipes entering the manhole.
2. Make openings at the manufacturing plant.
3. Size: To provide a uniform annular space between the outside wall of pipe and riser.
4. Location: To permit setting of the entering pipes at the correct elevations.
5. Openings shall have a flexible watertight union between pipe and the manhole wall.
   a. Cast into the manhole wall and sized to the type of pipe being used.
   b. Type of flexible joint being used shall be approved by the Engineer. Install materials according to the Manufacturer's instructions.
      i. Lock Joint Flexible Manhole Sleeve made by Interpace Corporation.
      ii. Kor N Seal made by Trelleborg.
      iii. Press Wedge II made by Press-Seal Gasket Corporation.
      iv. A-Lok Manhole Pipe Seal made by A-Loc Corporation.
      v. Or equivalent.

D. Joints:
1. Joint gaskets to be flexible self-seating butyl rubber joint sealant installed according to manufacturer's recommendations. Install a double row of joint sealants for every manhole joint. For cold weather applications, use adhesive with joint sealant as recommended by manufacturer.
   Acceptable Materials:
   a. Kent-Seal No. 2
   b. Ram-Nek
   c. Or equivalent.
2. Joints between precast sections shall conform to related standards and manufacturer's instructions.

3. All manholes greater than 6 ft. diameter and all manholes used as wet wells, valve pits and other dry-pit type structures shall be installed with exterior joint collars. The joint collar shall be installed according to the manufacturer's instructions.
   Acceptable Materials:
   a. MacWrap exterior joint sealer as manufactured by Mar-Mac Manufacturing Company
   b. Cretex External Joint Wrap
   c. Or equivalent.

E. Dampproofing:
1. The exterior surface of all manholes shall be given two coats of dampproofing material at an application rate as recommended by the manufacturer.
2. The coating shall be applied after the manholes have cured adequately and can be applied by brush or spray in accordance with the manufacturer's written instruction.
3. Sufficient time shall be allowed between coats to permit sufficient drying so that the application of the second coat has no effect on the first coat.

F. Frost Heave Protective Wrapping:
1. The frost heave protective wrap shall be constructed of a polyethylene material and shall be a minimum thickness of 6 mils.

2.2 FRAMES AND COVERS

A. Standard Units:
1. Made of cast iron conforming to ASTM A48 latest edition, Class 30 minimum.
2. Have machined bearing surfaces to prevent rocking.
3. Castings shall be smooth with no sharp edges.
4. Constructed to support an H-20 wheel loading.
5. Dimensions and Style shall conform to the Drawings, Standard castings differing in non-essential details are subject to approval by the Engineer:
   a. Covers - Solid with sewer in 3-inch letters diamond pattern. Pick hole dimensions shall not exceed the thickness of the frame inner flange.
   b. Frame - 24-inch diameter clear opening, with flange bracing ribs.

B. Water Tight Units:
1. Same features as above for Standard Units, with 22-inch diameter minimum clear opening.
2. Sealing features:
   a. Inner lid held by a bronze tightening bolt in a locking bar.
   b. Neoprene gasket
   c. Water tight pick hole.
3. Constructed to support H-20 wheel loading.

2.3 EXTERIOR CHIMNEY WRAP

A. One-piece flexible, molded wrap/seal manufactured from rubber and non-hardening butyl mastic.

B. Shall meet the following minimum standards:

1.	Elongation	ASTM D412	350%
2.	Tensile	ASTM D412	1,200 PSI/min
3.	Hardness	ASTM D2240	60 Duro

C. The wrap shall not need any heat for be molded to the frame and chimney.

2.4 MANHOLE STEPS

A. Polyethylene coated steel safety type designed with a minimum concentrated live load of 300 pounds.

B. Thoroughly clean all surfaces to be embedded with a suitable cleaning agent to ensure that the surfaces are free from all foreign matter such as dirt, oil and grease.

C. The steps shall become thoroughly dry before being placed into the concrete.

D. All steps shall be cast or drilled into walls of the precast section so as to form a continuous ladder with a distance of 12-inches between steps.

2.5 MASONRY

A. Brick:
1. Sound, hard, uniformly burned, regular and uniform in shape and size, compact texture, and satisfactory to the Engineer.
2. Immediately remove rejected brick from the work.

B. Mortar:
1. Composition (by volume):
   a. 1 part portland cement.
   b. 1/2 part hydrated lime.
   c. 4-1/2 parts sand.
2. The proportion of cement to lime may vary from 1:1/4 to 1:3/4, but in no case shall the volume of sand exceed 3 times the sum of the volume of cement and lime.
3. Cement shall be Type II portland cement.
4. Hydrated lime shall be Type S.
5. Sand:
   a. Shall consist of inert natural sand.
   b. Grading:

Sieve	Percent Passing
No. 4	100
No. 8	95-100
No. 16	70-100
No. 30	40-75
No. 50	10-35
No. 100	2-15
No. 200	0-5

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Precast Manhole Sections:
1. Perform jointing in accordance with manufacturer's recommendations and as approved by the Engineer.
2. Install riser sections and tops level and plumb.
3. Make all joints watertight.

4. When necessary, cut openings carefully to prevent damage to barrel sections and tops. Replace damaged manhole sections and tops at no additional cost to the Owner. When manhole steps are included in the Work, install barrel sections and tops so that steps are in alignment.

B. Drop Manholes:
1. The difference in elevation between the invert of the inlet pipe and outlet pipe is to be either less than 6-inches (which does not require a drop manhole) or more than 24-inches (which does require a drop manhole).
2. Where difference in elevation between the invert of the inlet pipe to the invert of the outlet pipe exceeds 24 inches, construct a drop manhole as shown on the Drawings or as directed by the Engineer.

C. Adjust to Grade:
1. Adjust tops of manholes to grade with brick masonry.
2. Concrete rings are not acceptable for adjusting to grade.
3. In paved areas, set frame and cover to final grade after binder pavement is placed and the grade of surface pavement has been determined.

D. Pipe Connections to Manholes: Connect pipes to manholes with joint design and materials approved by the Engineer. Special care shall be taken to ensure that the openings through which pipes enter the structure are watertight.

E. Invert Channels:
1. After manhole and all pipes entering or exiting the manhole have been installed, construct the invert channels and shelf.
2. Channels to be smooth and semicircular in shape conforming to the inside of the adjacent sewer section.
3. Make changes in direction of flow with smooth curves having a radius as large as permitted by the size of the manhole.
4. Stop the pipes at the inside face of the manhole where changes of direction occur. Form invert channels and shelf with brick. Form invert channels and shelf with smooth and carefully shaped 2500 psi concrete with no voids. Coat concrete with non-slip, hi-build epoxy coating.
6. The maximum change in elevation from the invert of the inlet pipe to the invert of the outlet pipe is 6-inches. Shape invert to make smooth transition in vertical grade.
7. Slope the floor of the manhole (shelf) to the flow channel, as shown on the Drawings.

F. Masonry:
1. Laying Brick:
   a. Use only clean bricks in brickwork for manholes.
   b. Moisten the brick by suitable means until they are neither so dry as to absorb water from the mortar nor so wet as to be slippery when laid.
   c. Lay each brick in a full bed and joint of mortar without requiring subsequent grouting, flushing, or filling, and thoroughly bond as directed.
   d. Construct all joints in a neat workmanlike manner. Construct the brick surfaces inside the manholes so they are smooth with no mortar extending beyond the bricks and no voids in the joints. Maximum mortar joints shall be 1/2 inch.
   e. Outside faces of brick masonry shall be plastered with mortar from ¼-inch to 3/8-inch thick.
   f. Completed brickwork shall be watertight.
2. Curing:

a. Protect brick masonry from drying too rapidly by using burlaps which are kept moist, or by other approved means.

b. Protect brick masonry from the weather and frost as required.

G. Frames and Covers:
1. Set all frames in a full bed of mortar, true to grade and concentric with the manhole opening.
2. Completely fill all voids beneath the bottom flange to make a watertight fit.
3. Place a ring of mortar at least one inch thick around the outside of the bottom flange, extending to the outer edge of the manhole all around its circumference.
4. Clean the frame seats before setting the covers in place.

H. Exterior Chimney Wrap
1. Clean frame's flange and chimney with a wire brush and a whisk broom.
2. Frame and chimney must be dry.
3. Apply an aerosol primer on frame flange and chimney per manufacturer's recommendations.
4. Install wrap/seal around chimney.
5. Remove tape from the butyl mastic on top section of wrap and seal it to the frame's flange.

I. Plugging and Patching:
1. Fill all exterior cavities with non-shrink grout and with bituminous waterproofing once the concrete and mortar has set.
2. Touch up damaged water proofing.

J. Cleaning:
1. Thoroughly clean manholes, steps, frames and covers of all debris and foreign matter.

K. Bedding and Backfilling:
1. Bedding of manholes shall be 6 inches of 3/4" screened stone.
2. Backfill a minimum of 18 inches all around manhole with gravel borrow.

L. Frost Heave Protective Wrap:
1. The Contractor shall comply with the manufacturer's instructions for the particular conditions of installations in each case.
2. Clean each manhole exterior of all dirt and remove any sharp protrusions.
3. Apply two 6-inch wide vertical strips of bituminous waterproofing material and/or duct tape from the top to bottom of the manhole per layer.
4. Prior to installing pipe through each manhole or valve pit, wrap each manhole to the maximum depth of frost penetration, but not less than 5 feet below grade, with four layers of the polyethylene material by beginning the wrap at the adhesive strip and proceeding around the manhole, valve pit, etc., continuously by overlapping the adhesive strip by 24 inches on the final layer. Cut the polyethylene wrap in areas where piping exits the manhole. The size of the cut is to be equivalent to the pipes outside diameter.
5. Tuck and pleat the polyethylene wrap at the top of each manhole in a continuous manner, minimizing the size of each fold. Extend the polyethylene wrap past the top of the manhole frame and temporarily tuck the remainder inside the frame, until final backfill and paving.
6. In paved areas, cut the polyethylene wrap flush with the manhole rim after the pavement is in place.
7. In unpaved areas, pull the polyethylene wrap together, and tie around frame with galvanized wire.

8. Protect the installed frost barrier from harmful weather exposures and from possible physical abuses, where possible by prompt installation of concealing work or, where that is not possible, by temporary covering or enclosure.
9. Backfill around the manhole/frost barrier with material as outlined in Section 02200 - Earthwork.

3.2 MANHOLE TESTING

A. General:
   1. Perform a vacuum test on all manholes
   2. Perform all testing in the presence of the Engineer.
   3. Suitably plug all pipes entering each manhole and brace plugs to prevent blow out.

B. Vacuum Test:
   1. The manhole shall be tested by a vacuum test after assembly of the manhole, connection piping and backfilling. Vacuum testing to be conducted prior to construction of invert channels.
   2. Plug all lifting holes completely with non-shrink grout.
   3. Properly tighten all boot clamps and brace all plugs to prevent them from being sucked into the manhole.
   4. Install the testing equipment according to the manufacturer's instructions.
   5. A vacuum of 10 inches of Hg shall be drawn on the manhole and the loss of 1 inch of Hg vacuum timed. The manhole shall be considered to have passed the test if the time for the loss of 1 inch of Hg vacuum is:
      a. Greater than 2 minutes for manholes less than 10-feet deep.
      b. Greater than 2.5 minutes for manholes 10 to 15-feet deep.
      c. Greater than 3 minutes for manholes more than 15-feet deep.
   6. If the manhole fails the initial test, the Contractor shall locate the leak(s) and make repairs. The manhole shall be retested until a satisfactory test result is obtained.

3.3 FIELD REPAIRS

A. Structural repairs shall be completed at the direction of the Engineer.

B. Leakage Repairs
   1. Correct leakage by reconstruction, replacement of gaskets and/or other methods as approved by the Engineer.
   2. The use of lead-wool or expanding mortar will not be permitted.

C. After the manholes have been backfilled, and prior to final acceptance, any signs of leaks or weeping visible inside the manholes shall be repaired and the manhole made watertight.

END OF SECTION

SECTION 33 05 97.16
BURIED UTILITY MARKINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. This work shall consist of providing and installing utility line markings above all buried lines installed as part of this contract and replacing existing markings disturbed as part of this contract. Buried utilities are indicated on the Civil and Electrical Drawings.

1.2 REQUIREMENTS SPECIFIED ELSEWHERE

A. Additional Requirements are specified elsewhere including, but not necessarily limited to, General Conditions and Supplementary Conditions.

1.3 SUBMITTALS

A. Submit shop drawings in accordance with the applicable section of these specifcations and the General Conditions of the Construction Contract.

B. Submit manufacturer's "Certification of Conformance" that utility markings meet or exceed the requirements of these Specifications.

C. Submit manufacturers specifications for utility markings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials and color shall be in accordance with latest AASHTO specifications for pipe and utility marking.

B. Marking tape color shall be in accordance with latest American Public Works Association (APWA) Uniform Color Code and American National Standards Institute ANSI Standard Z535.1, Safety Color Code specifications for buried utility marking as noted in the Schedule below.

1. Schedule

Marker Color	Buried Utility
Blue	Potable Water &Associated lines
Green	Sanitary Sewers, Storm Drain and other Drain lines
Orange	Telecommunication, signal, alarm
Purple	Reclaimed, Recycled, Irrigation Water and Slurry Lines
Red	Electric Power lines cables conduits and lighting cables
Yellow	Gas, Oil, Steam, Petroleum or Gaseous Material Lines

2. Warning Information shall be in Black Letters with typical wording of:

a. "CAUTION: BURIED (NAME OF UTILITY LINE) BELOW"

C. For ferrous pipe material use 0.004" minimum polyethylene film; 6" wide clearly marking type of buried utility.

D. For non-ferrous pipe material (e.g. Concrete, PVC, PE, etc.) use detection tape composite of polyethylene and metallic core 6" wide clearly marking type of buried utility.

E. Seton Identification Products, New Haven, CT, Utility Safeguard LLC or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Marking tape shall be installed over utility lines centerline and buried 24" below grade.

B. Markings damaged during opening of trench shall be reinstalled with 2' overlap at broken sections.

END OF SECTION

SECTION 33 31 00
SANITARY UTILITY SEWERAGE PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Provide and install PVC non-pressure pipe and fittings of the size(s) and type(s) and in the location(s) shown on the Drawings and as specified herein.

B. Related Work Specified Elsewhere: (When Applicable)

1. Excavation and backfill, dewatering, pavement, borrow and bedding material, and cleaning and testing requirements are specified in the appropriate sections of this division.

1.2 QUALITY ASSURANCE

A. Manufacturers:

1. Certain-Teed.
2. J-M Manufacturing.
3. Or equivalent.

1.3 SUBMITTALS TO THE ENGINEER

A. Submit shop drawings in accordance with the General Conditions of the Construction Contract.

B. Submit manufacturer's "Certification of Conformance" that pipe and fittings meet or exceed the requirements of these Specifications.

C. Submit other documents as specified in the appropriate Sections of this Division.

1.4 DELIVERY STORAGE AND HANDLING

A. Provide all labor necessary to assist the Engineer to inspect pipe, fittings, gaskets and other materials.

B. Carefully inspect all materials at the time of delivery and just prior to installation.

C. Carefully inspect all pipe and fittings for:

1. Defects and damage
2. Deviations beyond allowable tolerances for joint dimensions.
3. Removal of debris and foreign matter.

D. Examine area and structures to receive piping for:

1. Defects, such as weak structural components that adversely affect the execution and quality of work.
2. Deviations beyond allowable tolerance for pipe clearances.

E. All materials and methods not meeting the requirements of the Contract Documents will be rejected.

F. Immediately remove all rejected materials from the project site.

PART 2 - MATERIALS

2.1 MATERIALS

A. Pipe and Fittings:

1. The polyvinyl chloride pipe and fittings, including those required for stubs, shall conform to ASTM standard specification for PVC Sewer Pipe and Fittings, Designation D 3034 (SDR 35) (4" to 15"), F679 (18" to 27").
2. Straight pipe shall be furnished in lengths of not more than 14 feet.
3. Saddles will not be allowed.

B. Joints:

1. Joints for the polyvinyl chloride pipe shall be push-on joints using factory installed elastomeric ring gaskets.
2. The gaskets shall be securely fixed into place by the manufacturer so that they cannot be dislodged during joint assembly.
3. The gaskets shall be of a composition and texture which is resistant to common ingredients of sewage and industrial wastes, including oils and ground water, and which will endure permanently under the conditions of the proposed use.
4. The joints shall conform to ASTM Specifications for Joints for Drain and Sewer Plastic Pipes using Flexible Elastomeric Seals, Designation D3212-76.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Inspection:

1. Each pipe unit shall be inspected before being installed. No single piece of pipe shall be laid unless it is generally straight.
2. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 1/16 inch per foot of length.
3. If a piece of pipe fails to meet this requirement for straightness it shall be rejected and removed from the site.
4. Any pipe unit or fitting discovered to be defective either before or after installation shall be removed and replaced with a sound unit.

B. Jointing:

1. All pipe and fittings shall be cleared of all debris, dirt, etc., before being installed and shall be kept clean until accepted in the completed work.
2. Pipe and fittings shall be installed to the lines and grades indicated on the drawings or as required by the Engineer. Care shall be taken to insure true alignments and gradients.
3. All joint surfaces shall be cleaned. Immediately before jointing the pipe, the bell or groove shall be lubricated in accordance with the manufacturer's recommendation.

4. Each pipe unit shall than be carefully pushed into place without damage to pipe or gasket. Suitable devices shall be used to force the pipe units together so that they will fit with a minimum open recess inside and outside and have tightly sealed joints. Care shall be taken not to use such force as to wedge apart and split the bell or groove ends.
5. Joints shall not be "pulled" or "cramped" unless permitted by the Engineer.

C. Service Connections:
1. All service connections to new pipe shall utilize a wye fitting.
2. All service connections must enter the top half of the mainline pipe.

D. Pipe Deflection:
1. Pipe provided under this specification shall be installed so there is no more than a maximum deflection of 5.0 percent. Such deflection shall be computed by multiplying the amount of deflection (normal diameter less minimum diameter when measured) by 100 and dividing by the nominal diameter of the pipe.
2. The Contractor shall wait a minimum of 30 days after completion of a section of sewer, including placement and compaction of backfill, before measuring the amount of deflection by pulling a specially designed gage assembly through the completed section. The gage assembly shall be in accordance with the recommendations of the pipe manufacturer and be acceptable to the Engineer.
3. Should the installed pipe fail to meet this requirement, the Contractor shall do all work to correct the problem as the Engineer may require without additional compensation.

E. Testing:
1. Clean and test pipe in accordance with appropriate sections of this division.

END OF SECTION

SECTION 33 41 00
STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Provide and install culvert or storm drain pipe and sections of the type(s), size(s) and in the location(s) shown on the Drawings and as specified herein.

B. Related Work Specified Elsewhere:

1. Excavation and backfill, dewatering, catch basins, pavement, borrow and bedding material are specified in the appropriate sections in this division.

1.2 SUBMITTALS

A. Submit, in duplicate, sworn certificates of inspections and tests performed at the location of manufacturers.

B. Submit shop drawings in accordance with the General Conditions of the Construction Contract.

1.3 DELIVERY, STORAGE AND HANDLING

A. Exercise care when handling pipe to prevent damage of any nature to pipe and finish.

B. Immediately remove damaged materials and replace at no additional cost to the Owner.

C. Store materials above ground on platforms, skids or other adequate supports.

1.4 FIELD QUALITY CONTROL

A. Acceptance will be on the basis of tests of materials and inspection of the complete product.

B. Inspection may be made at the place of manufacture or on the construction site after delivery, or both, and the pipe shall be subject to rejection at any time due to failure to meet all of the specification requirements, even though sample pipe units may have been accepted as satisfactory at the place of manufacture.

C. Immediately remove from the project site all rejected pipe.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pipe shall be one of the following as specified on the Drawings or at the option of the Contractor and with the approval of the Engineer.

1. Corrugated Polyethylene (PE) Pipe
2. Reinforced Concrete Pipe

B. Materials for pipes shall conform to Standards listed as follows:

1. PVC (Polyvinylchloride) Pipe. This pipe and fittings shall conform to the requirements of AASHTO M278. All pipe shall be supplied with gasket type joints meeting the requirements of ASTM D3212.
2. Corrugated polyethylene pipe. This pipe and fittings shall conform to the requirements of AASHTO M252 and AASHTO M294 or ASTM F2648. The pipe joint system shall be watertight (WT) and shall meet or exceed the current ASTM D3212 Lab Test Requirements and the current ASTM F1417 Watertight Field Test Requirements.
3. Reinforced Concrete Pipe. This pipe shall conform to the requirements of AASHTO M170, (ASTM C76) except paragraph 6.2. Elliptical pipe shall conform to the requirement of AASHTO M207, except paragraph 6.2. Unless otherwise specified, pipe wall design and use of elliptical reinforcement in circular pipe are optional. Pipe arch shall conform to the requirements of AASHTO M206, except paragraph 6.2.

   Aggregates shall meet the requirements of MDOT Standard Specifications Subsections 703.01 and 703.02 for fine aggregates and coarse aggregates respectively, except that grading requirements are hereby waived.

   Precast reinforced concrete special sections shall conform to the requirements of the cited specifications to the extent to which they apply.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas to receive piping for the following:
   1. Obstructions that adversely affect the installation and quality of the work.
   2. Deviations beyond allowable tolerances for clearances.

B. Examine pipe and fittings before installation to assure no defective materials are incorporated.

C. Start the work only when conditions are satisfactory.

D. Remove and replace all defective materials at no additional cost to the Owner.

3.2 INSTALLATION

A. Do not install pipe, nor backfill, between December 15 and April 1 without the written permission of the Engineer.

B. Begin laying the pipe at the downstream end.

C. Place metal pipe with the longitudinal laps of seams at the sides and the outside laps of circumferential joints pointing up grade.

D. Lay paved or partially lined pipe with the lining on the bottom.

E. Join flexible pipe sections and metal end sections by coupling bands.

F. Assemble the plates for structural plate arches according to the manufacturer's assembly instructions and as shown on the Drawings.

END OF SECTION

SECTION 33 42 31

CATCH BASINS, GRATES AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Construct catch basins, grates, frames and brick masonry in conformance with the dimensions and locations shown on the Drawings.

1.2 REQUIREMENTS SPECIFIED ELSEWHERE

A. Additional Requirements are specified elsewhere including, but not necessarily limited to, General Conditions and Supplementary Conditions.

1.3 QUALITY ASSURANCE

A. Precast Catch Basin Base, Barrel and Top Sections:
   1. Conform to ASTM C478-97 except as modified herein, on the Drawings, or as directed by the Engineer.
   2. Minimum strength of 4,000 psi at 28 days
   3. Testing:
      a. Determine concrete strength by tests on 6 inch by 12 inch vibrated test cylinders cured in the same manner as the bases, barrels and tops.
      b. Have tests conducted at manufacturer's plant or at an approved testing laboratory.
      c. Have not less than 2 tests made for each 100 vertical feet of precast catch basin sections.

B. Frames and Covers:
   1. Acceptable Manufacturers:
      a. EJ Group, Inc.
      b. Neenah Foundry Company
      c. Or equivalent.

C. Masonry:
   1. Brick: Shall comply with the ASTM Standard Specifications for Sewer Brick (made from clay or shale), Designation C32, for Grade SS, hard brick.
   2. Cement: ASTM C-150.
   3. Hydrated Lime: ASTM C-207.
   4. Sand: ASTM C144.

D. Pipe connections shall conform to ASTM C923, "Standard Specifications for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals"
Grade rings for frame and cover adjustments shall be made from expanded polypropylene. Pro-Rings or equivalent.

1.4 SUBMITTALS TO THE ENGINEER

A. Submit shop Drawings and manufacturer's literature in conformance with the Standard

General Conditions of the Construction Contract.

B. Bases, Barrel Sections and Tops: Submit test results and receive approval from the Engineer prior to delivery to the site.

PART 2 - PRODUCTS

2.1 PRECAST CATCH BASIN SECTIONS

A. Dimensions, as shown on the Drawings.

B. Use flat tops or eccentric cones as appropriate. Exterior face of cone sections shall not flare out beyond the vertical.

C. Joints: Bell-and-spigot or tongue-and-groove formed on machine rings to ensure accurate joint surfaces.

D. Constructed to support an HS-20 wheel loading.

E. Openings:
1. Provide openings in the risers to receive pipes entering the catch basin of the types and materials approved by the Engineer.
2. Make openings at the manufacturing plant or cut openings in the field.
3. Size: To provide a uniform annular space between the outside wall of pipe and the riser.
4. Location: To permit setting of the entering pipes at the correct elevations.

F. Joints:
1. Joint gaskets to be flexible self seating butyl rubber joint sealant installed according to manufacturer's recommendations. For cold weather applications, use adhesive with joint sealant as recommended by manufacturer.
2. Acceptable Materials:
   a. Kent-Seal No. 2
   b. Ram-Nek
   c. Or equivalent.
3. Joints between precast sections shall conform to related standards and manufacturer's instructions.

2.2 FRAMES AND GRATES

A. All essential details of design shall conform to the Drawings. Standard castings differing in non-essential details may be approved by the Engineer.

B. All frames and grates shall be made of cast iron and shall have machined bearing surfaces to prevent rocking under traffic.

C. Grate castings will be smooth with no sharp edges.

D. Constructed to support an HS-20 wheel loading.

2.3 MASONRY

A. Brick:
1. Sound, hard, uniformly burned, regular and uniform in shape and size, compact texture, and satisfactory to the Engineer.
2. Immediately remove rejected brick from the work.

B. Mortar:
1. Composition (by volume):
a. 1 part portland cement.
b. 1/2 part hydrated lime.
c. 4-1/2 parts sand.
2. The proportion of cement to lime may vary from 1:1/4 for hard brick to 1:3/4 for softer brick, but in no case shall the volume of sand exceed 3 times the sum of the volume of cement and lime.

C. Cement:
1. Shall be Type II portland cement.

D. Hydrated Lime:
1. Shall be Type S.

E. Sand:
1. Shall consist of inert natural sand.

F. Grading:

Sieve	Percent Passing
No. 4	100
No. 8	95-100
No. 16	70-100
No. 30	40-75
No. 50	10-35
No. 100	2-15
No. 200	0-5

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Precast Catch Basin Sections:
1. Perform jointing in accordance with manufacturer's recommendations and as approved by the Engineer.
2. Install barrels and tops level and plumb.
3. Make all joints water tight.
4. Solidly fill annular spaces around pipes entering the catch basin with non-shrink grout or other material approved by the Engineer.
5. Cut openings (as required) carefully to prevent damage to barrel sections and tops. Damaged barrel sections and tops shall be replaced by the Contractor at no additional expense to the Owner.

B. Pipe Connections to Catch Basins and Drain Manholes: Connect pipes to manholes with joint design and materials approved by the Engineer. Special care shall be taken to ensure that the openings through which pipes enter the structure are watertight.

C. Masonry:
1. Laying Brick:
a. Use only clean bricks in brickwork for catch basins.
b. Moisten the brick by suitable means until they are neither so dry as to absorb water from the mortar or so wet as to be slippery when laid.

c. Lay each brick in a full bed and joint of mortar without requiring subsequent grouting, flushing, or filling, and thoroughly bond as directed.

d. Construct all joints in a neat workmanlike manner, construct the brick surfaces inside the manholes so they are smooth with no mortar extending beyond the bricks and no voids in the joints. Maximum mortar joints shall be 1/2 inch.

2. Curing:

a. Protect brick masonry from drying too rapidly by using burlaps which are kept moist, or by other approved means.

b. Protect brick masonry from the weather and frost as required.

D. Frames and Grates:

1. Set all frames in a full bed of mortar, true to grade and concentric with the catch basin opening.
2. Completely fill all voids beneath the bottom flange to make a watertight fit.
3. Place a ring of mortar at least one inch thick around the outside of the bottom flange, extending to the outer edge of the catch basin all around its circumference.
4. Clean the frame seats before setting the covers in place.

E. Bedding and Backfilling:

1. Bedding material of catch basin shall be 6 inches of screened stone (see Section 02200).
2. Backfill 18 inches all around catch basin with gravel borrow.

END OF SECTION

SECTION 33 47 40
STORM DRAINAGE SOIL FILTER SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included - Furnish all labor, materials, equipment and tools necessary for the installation of the underdrained soil filter system complete, make ready for operation and field test the soil filter system as shown on the drawings and as specified herein.

B. Related Work Specified Elsewhere:

1. Clearing and Grubbing as specified in Section 31 11 00.
2. Earthwork as specified in Section 31 00 00.
3. Temporary Erosion Control as specified in Section 31 25 00.

C. Regulatory Guidance

1. It is the intent to have the soil filter construction conform to the guidelines establish in the latest edition of the Maine Department of Environmental Protection Volume III: BMPs Technical Design Manual, Chapter 7.5, Roof Dripline Filtration BMP

C. System Function:

1. The soil filter system shall consist of roof dripline filter (RDF) impoundment in the location shown on the plans. The impoundment will capture and treat stormwater from a distinct watershed. The stormwater will be filtered through the soil media and collected in the underdrains and discharged to an outlet.

1.2 QUALITY ASSURANCE

A. All material supplied shall conform to applicable standards. All material provided shall be new and free from defects.

1.3 SUBMITTALS

A. Submit shop drawings in accordance with the General Conditions of the Construction Contract.

B. Submit Manufacturer's "Certification of Conformance" that the pipe, fittings, filter fabric, and soil and other appurtenances meet or exceed the requirements of these specifications.

1.4 DELIVERY, STORAGE AND HANDLING

A. Exercise care during loading, transporting, unloading, and handling to prevent damage of any nature to interior and exterior surfaces of pipe and fittings.

B. Do not drop pipe and fittings.

C. Store materials on the project site in enclosures or under protective coverings in accordance with manufacturer's recommendations and as required by the Engineer.

D. Assure that materials are kept clean and dry.

E. Do not store materials directly on the ground.

F. Follow manufacturer's specific instructions, recommendations and requirements.

G. If damage occurs, immediately make all repairs and replacements necessary to the satisfaction of the Engineer at no cost to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. High density polyethylene corrugated underdrains.

2.2 DRAINAGE LAYER

A. The underdrain drainage layer material shall consist of well graded, clean, coarse gravel meeting MDOT Specification 703.22 Underdrain Type C for Underdrain Backfill Material. The material will meet the following gradation:

Sieve Size	% by Weight
1”	100
¾”	90 -100
3/8”	0 - 75
#4	0 - 25
#10	0 – 5

2.3 FILTER SAND

B. Sand meeting MDOT specifications 703.01 Aggregate

2.4 GEOTEXTILE-MEMBRANE

A. As Specified in Section 31 05 19.

PART 3 - EXECUTION

3.1 FILTER EXCAVATION

A. The filter area will be excavated to the grades as shown on the plans.

B. The excavation shall be lined with filter fabric.

C. The outlet piping shall be installed and protected from silt.

D. The filter media and underdrain bedding shall not be placed as shown in the plans.

E. The filter shall be covered until the area is stabilized and is under threat of contamination from surrounding surfaces.

F. Vehicular traffic shall not be allowed near the filter once piping is in place.

END OF SECTION

DEPARTMENT OF COMMERCE
FINANCIAL ASSISTANCE
STANDARD TERMS AND CONDITIONS



12 November 2020

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 entity[1] 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.

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[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.

l. 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.

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