HARRIMAN

University of Southern Maine
Central Heat Plant Upgrades
Portland, ME

Project No. 14411

October 31, 2014

Issued for Bid

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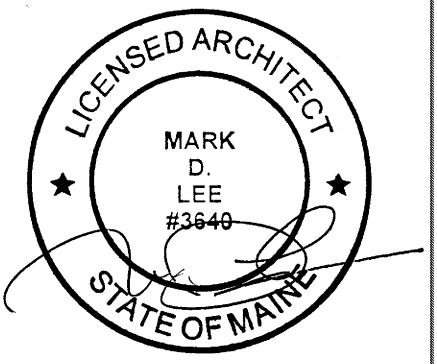
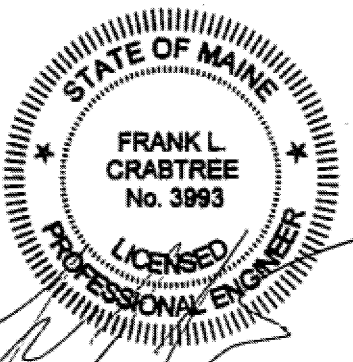
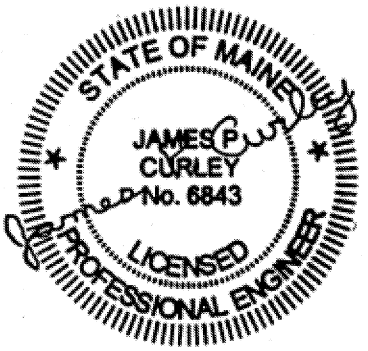
Architect
HARRIMAN



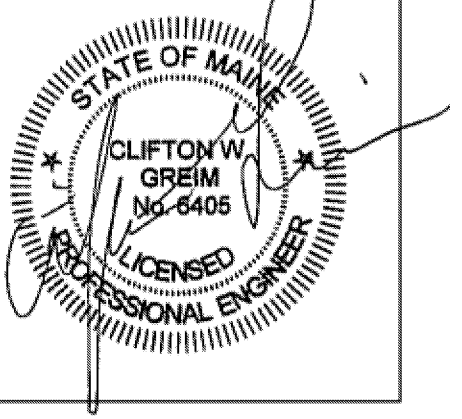
Civil Engineer
HARRIMAN



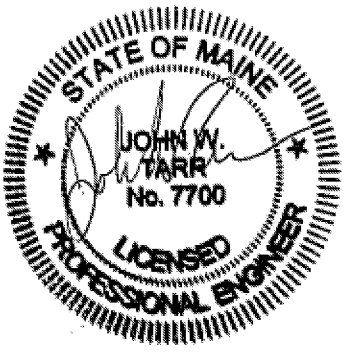
Structural Engineer
HARRIMAN



Mechanical Engineer
HARRIMAN



Electrical Engineer
HARRIMAN



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PROJECT MANUAL

FOR

USM

at

CENTRAL HEAT PLANT UPGRADES

PORTLAND, MAINE

Prepared by:

Harriman
October 31, 2014

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UNIVERSITY OF SOUTHERN MAINE
CENTRAL HEAT PLANT UPGRADES
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NOTICE TO CONTRACTORS AND SUBCONTRACTORS
REQUEST FOR BIDS
(Advertisement)

Sealed Bids in envelopes plainly marked for: **Portland Central Heat Plant Upgrades, 2012-016,** addressed to:

University of Southern Maine,
c/o **Timothy Braun**
Building Construction Engineer
25 Bedford Street, Portland, Maine 04104

Bids will be received until **2:00 p.m. on November 25, 2014 at University of Southern Maine- Portland Campus, 25 Bedford Street, Portland, Maine 04104 in the Facilities Management conference room,** at which time they will be opened and read aloud**.** Notice to Proceed is anticipated shortly after the bid opening, and **Substantial Completion is September 1, 2015**.
Sealed Bids may also be hand delivered to **Facilities Management, 25 Bedford Street, on the University of Southern Maine –Portland Campus.**. Proposals received after the stated time will not be considered and will be returned unopened.

Bids must be accompanied by a satisfactory Bid Security Form, as prescribed in Section 00 43 13, for 5% of the Bid (checks will not be accepted).

The University reserves the right to waive all formalities and reject any and all Bids or to accept any Bid.

The successful bidder will be required to furnish a 100% Performance Bond and 100% Payment Bond to cover the execution of the contract which shall be in conformity with the form of Bonds contained in Sections 00 61 13.13 and 00 61 13.16 of the Specifications and for the contract amount.

Project Summary: The University of Southern Maine, a member of the University of Maine System desires to procure construction services to renovate approximately 3,500 square feet at the Central Heat Plant on the Portland Campus. The work requires removal and replacement three existing boilers, HVAC, electrical, plumbing and building upgrades.

Subcontractors submitting Bids to General contractors for Work listed on General Contractor's Bid Form and the Notice to Contractor's Form are required to send or deliver a copy of their Bids to the Maine Construction Bid Depository, Whitten Road (P.O. Box N), Augusta, Maine 04330, and to be considered valid, must be received in the Bid Depository on or before 3:00 PM on **November 19, 2014,** in accordance with the supplemental instructions to Bidders, Section 00 22 13 and the General Conditions and Regulations of the Maine Construction Bid Depository, on the form provided.

Subcontract Bids filed with the Bid Depository must be accompanied by a satisfactory Bid Bond, in conformity with the Form of Bond contained in Section 00 43 13.10, made out to the Owner, for 5% of the Sub-Bid Amount, and filed separately in the WHITE envelope.

The selected Subcontractors, required to file their Sub-Bids with the Bid Depository, will also be required to furnish the selected General Contractor with a 100% Performance Bond and 100% Payment Bond, for their portion of the work.

Subcontractors required to file their Sub-Bids and Bid Bonds with the Bid Depository are as follows:

Plumbing: Division 22
Mechanical: Division 23
Electrical: Division 26

Official Forms and Envelopes for all Sub-Bids may be obtained from the Office of the Maine Construction Bid Depository, Whitten Road (P.O. Box N), Augusta, ME 04330.

A **Mandatory** pre-bid meeting and site walk-through will be held on **November 4, 2014 at 10:00 AM** at 25 Bedford Street, Portland, Maine 04104 in the Facilities Management conference room**. Bidding contractors and File Sub-Bid Subcontractors must attend to be considered** and other subcontractors are strongly encouraged to attend.

Bid Documents - full sets only - will be available on or about October 31, 2014 and may be purchased with a deposit of $260 (two checks for $130 each). Bidding General Contractors and Subcontractors who return plans and specifications unmarked and in good condition within 10 days of bid opening will receive a refund equal to one half of their deposit. All General Contractors and Subcontractors who do not bid will receive no refund of their deposit. Documents may be purchased from:

Harriman
46 Harriman Drive
Auburn, Maine 04210
207-784-5100

The documents may be examined at the following places:

AGC of Maine, 188 Whitten Road, Augusta ME 04332-5519, (207) 622-4741; smetrano@agcmaine.org
McGraw-Hill Construction/Dodge, 224 Gorham Road, Scarborough, ME 04074, (207) 883-4856; Dodge_Document_NA@mcgraw-hill.com, Dodge_ReocNA@mcgraw-hill.com
Construction Summary of NH, Maine & VT: info@constructionsummary.com ; (800) 321-8856
University of Southern Maine, 25 Bedford Street, Portland, Maine 04104
University of Southern Maine, 30 University Way, Gorham, Maine 04038
University of Maine System, 16 Central Street, Bangor, Maine 04401

The University of Maine System in all its activities, subscribes and adheres to the provisions of the Civil Rights Act of 1964 as amended to date. General contractors, subcontractors, and product suppliers bidding on this project must subscribe and adhere to same. There shall be no discrimination in employment because of race, color, religion, sex, sexual orientation, including transgender status or gender expression, national origin or citizenship status, age, disability, genetic information, or veterans status in employment, education, and all other areas of the University.

University of Southern Maine
Robert W. Bertram
Executive Director of Facilities Management
for
The University of Maine System Board of Trustees

NOTICE TO CONTRACTORS

(Advertisement)

The **University of Southern Maine** is seeking bids for the following construction project:
Portland Central Heat Plant Upgrades, 2012-016

Project Summary: Renovate approximately 3,500 square feet at the Central Heat Plant on the Portland Campus. The work requires removal and replacement three existing boilers, HVAC, electrical, plumbing and building upgrades.

File Sub Bids must be received in the Bid Depository on or before **3:00 PM on November 19, 2014**

Bids will be received until **2:00 p.m. November 25, 2014,** at which time they will be opened and read aloud.

A **Mandatory** pre-bid meeting and site walk-through will be held on **November 4, 2014 at 10:00 AM at 25 Bedford Street, Portland, Maine 04104 in the Facilities Management conference room. Bidding contractors and File Sub-bid Subcontractors must attend to be considered** and other subcontractors are strongly encouraged to attend.

Additional information may be obtained at: **http://www.usm.maine.edu/facilities/current-projects**

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SECTION 00 21 13

Instructions to Bidders

1. At the time of the opening of bids, each bidder will be presumed to have inspected the site and to have read and to be thoroughly familiar with the plans and contract documents, including all addenda. The failure or omission of any bidder to receive or examine any form, instrument, or document shall not relieve any bidder from any obligation in respect to the bid. The Owner reserves the right to accept or reject any or all bids as may best serve the interests of the University of Maine System.
2. Subject to the University System's right, reserved herein, to accept or reject any or all bids, the General Contractor will be selected on the basis of the sum of the lowest base bid, plus such of the alternates as the University System desires to use.
3. The University System is exempt from the payment of Federal Excise Taxes on articles not for resale and the Federal Transportation Tax on all shipments. The Contractor shall quote less these taxes. Upon application, exemption certificates will be furnished when required.
4. No proposal may be withdrawn during a period of thirty (30) calendar days immediately following the opening thereof.
5. No contract may be assigned, sublet or transferred without the written consent of the University of Maine System.
6. All individuals not residents of this State must comply with the provisions of 14 M.R.S.A. §704-A.
7. The successful bidder, or bidders, will be required to furnish 100% Contract Bonds to cover the execution of the contract, in accordance with Article 23 of the General Conditions.
8. Contractors may be required to furnish a statement of their business experience, record of accomplishments, and financial responsibility, at the discretion of the University System.
9. The base bid shall be based on the materials, methods, equipment and products, as specified.
10. The Contractor shall submit his/her bid on the University provided Bid Form (00 41 13).
11. Any materials, methods, equipment and products not herein specified, but worthy of consideration by any General or Subcontractor, may be introduced by a separate letter attached to the regular bid. The Bidder shall state the cost comparison with the specified materials, methods, equipment and products, and the reason for the suggested substitution. It shall be understood by all bidders that the attached letter proposing substitutions shall not be used to determine the low bidder and that all bids are based on specified products.
12. Telegraphic or facsimile proposals will not be considered, but modification of proposals already submitted will be considered if received prior to the hour set for receipt of proposals. If the telegram or facsimile discloses the amount of the proposal, the proposal will be declared invalid. The bidder bears full responsibility to assure that the correction is delivered to the proper location and within the time required.
13. Where a bidder wishes a product to be considered an "approved equal" for bidding purposes, the product, along with all supporting documentation, shall be submitted to the architect for review a minimum of 10 calendar days prior to the bid opening date or the file bid due date, if file bids are required on the project. Products which are determined to be an "approved equal" for bidding purposes shall be listed in an addendum issued so as to be received by bidders no less than 72 hours prior to the bid date or the file bid due date if file bids are required.
14. Where the Proposal Form requires the tabulation of subcontractors other than "File Bidders," the Bidder shall list the name of the firm the bidder intends to use in the event the bidder receives the contract award.
15. Bidders may appeal the award decision by submitting a written protest to the University of Maine System's System Director of Facilities Management & General Services within five (5) business days of the date of the award notice, with a copy of the protest to the successful bidder. The protest must contain a statement of the basis for the challenge.

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SECTION 00 22 13

Supplemental Instructions to Bidders
For Filed Sub-bids

For University System Projects, the facilities of the Maine Construction Bid Depository shall be used, and all Subcontract Bid Proposals must be filed in accordance with the Regulations by the Maine Construction Bid Depository, a copy of which is included in these Specifications. Additional copies may be obtained from the Architect or the office of the ACM, Inc., Whitten Road, P.O. Box N, Augusta, Maine 04332-0551.

1.

a.) Subcontractors for trades, as listed in the General Contractor's Bid Form 00 41 13.10 and the Notice to Contractors Form 00 11 13, are required to deliver (or mail at their own risk) their Bid proposals to the Maine Construction Bid Depository, Whitten Road, P.O. Box N, Augusta, Maine 04332-0551 and, to be considered valid, must be received in the Bid Depository on or before the time stated in the Notice to Contractors, Section 00 11 13, in accordance with these Instructions to Bidders, on the form provided by the Architect. Any Bid proposal submitted on an incomplete form may be considered informal and not a valid Proposal.

b.) Subcontract Bid proposals, filed with the Bid Depository, must be accompanied by a satisfactory Bid Bond, in conformity with the Form of Bond contained in Section 00 41 13.10, made out to the Owner, for 5% of the Subbid Amount and filed separately in the WHITE envelope.

c.) After the General Contractor Bid opening, any filed Subcontract Bid Proposal not in conformity with these instructions, or not in conformity with the requirements of the Plans and Specifications shall be declared invalid and the filed Subcontract Bid Proposal of the lowest acceptable Subcontractor will be substituted. Such substitutions will be made prior to the selection of the General Contractor.

d.) At the closing time for filing Subcontract Bids, if the only filed Subcontract Bid Proposal for any individual trade or trades are filed by a General Contractor, it shall be assumed that such Subcontract Bid Proposal is restricted to said General Contractor and it will not be furnished to other General Contractors. In such an event, the University System shall establish a Lump Sum Allowance for such trade or trades and include it in the letter to General Contractors announcing the names of the Subcontractors filing Subcontract Bid Proposals. This Lump Sum Allowance shall be included in the Bid Proposal of all General Contractors.

e.) In the event a filed Subcontract Bid Proposal is requested, but none received, the University System shall establish a Lump Sum Allowance for that trade and include it in the letter to the General Contractors announcing the names of the Subcontractors filing Subcontract Bids. This Allowance shall be included in the Bid Proposal of all General Contractors in lieu of a filed Subcontract Bids.

f.) After opening the filed Subcontract Bid Proposals, if all are found to be invalid for any particular trade or trades, the amounts listed by General Contractors for that trade or trades in preparing their bids shall be deducted from the total of the Bid Proposal of each General Contractor and the Contract shall be awarded to the lowest responsible General Contractor selected after said deductions are made.

g.) Telegraphic or facsimile Subcontract Bid Proposals will not be considered, but modifications by telegram or facsimile of Subcontract Bids already filed will be considered if received prior to the hour set for receipt of Subcontract Bid Proposals. If the modification discloses the amount of the Subcontract Bid submitted, the Subcontract Bid Proposal will be declared invalid.

2.

a.) Any filed Sub-bid received from a General Contractor who does not have the qualified personnel or experience for that particular trade shall be considered informal and not a valid Subbid.

b.) At the expiration of the time stated for the filing of Sub-bids, the University System's Office of Facilities will mail to the General Contractors, who have taken Plans and Specifications, the names of Subcontractors who have filed their Sub-bid proposals with the Bid Depository in accordance with the provisions of these Instructions to Bidders. If any General Contractor has not received a copy of this list of Sub-bidders, within a reasonable time following the time set for their delivery, the bidder should contact the Office of Facilities for confirmation of the list of Sub-bidders who have filed, prior to the completion of the bidder's own Bid Proposal.

c.) General Contractors will be furnished by the Architect two (2) copies of the Bid Form for General Contractor. One (1) copy shall be filled out and signed and sent to the Owner in a printed envelope furnished by the Architect to arrive on or before the time specified in the "Notice to Contractors," Section 00 11 13.

d.) Each bid by a General Contractor shall be submitted on the form provided, and the list of selected Subcontractors with their respective Sub-bids shall be complete. Any Bid Proposal submitted by a General Contractor with an incomplete list of Subcontractors, or with the name or names of Subcontractor or Subcontractors who have not filed in accordance with these Instructions to Bidders, shall be considered informal and as such will not be considered a valid Bid proposal.

e.) Any Bid Proposal, submitted by a General Contractor, with a Sub-bid amount different from the Sub-bid Amount filed by that Subcontractor, shall have the Sub-bid Amount filed substituted for the Sub-bid Amount carried by the General Contractor, and the Bid Proposal of the General Contractor shall be adjusted by the difference, prior to the selection of the low General Contractor.

f.) Telegraphic or Facsimile Bid Proposals from the General Contractors will not be considered, but modifications by telegram facsimile of Bids already submitted will be considered, if received prior to the hour set for receipt of Bid Proposals. If the modification discloses the Amount of the Bid submitted, the Bid Proposal will be declared invalid.

3. The Owner reserves the right to reject any Subcontractor not qualified or whose Bid is invalid under these Supplemental Instructions to Bidders, and will, before the selection of the General Contractor, substitute another Subcontractor who is qualified and who has properly filed.

4. Subject to the Owner's right, reserved herein, to accept or reject any or all Bids, the General Contractor will be selected on the basis of the sum of the lowest acceptable Bid plus such of the Alternates as the Owner desires to use, it being understood that the Subcontractors listed in the said Bid Proposal shall be acceptable to the Owner.

5. After the selection of the General Contractor, the Bids of all Subcontractors will be considered by the Owner, the Architect, and the General Contractor. Any agreement to substitute the names of Subcontractors other than those named in the General Contractor's Bid Proposal shall cause an adjustment of the Contract Amount in accordance with the Owner's copy of the Subcontract Bid filed with the Bid Depository. If the said Subcontractor or Subcontractors so substituted fail to execute a Subcontract, in accordance with their filed Sub-bid, with the selected General Contractor and before a Contract between the Owner and the General Contractor has been executed, the Owner, Architect, and General Contractor shall select from the list of Subcontractors, who filed copies of their Bids, with the Bid Depository, a new Subcontractor or Subcontractors, and the Contract Amount shall be revised in accordance with the Subcontract Bids so filed.

The selected Subcontractors, required to file their Sub-bids with the Bid Depository, are also required to furnish the Selected General Contractor with a 100% Performance Bond and 100% Payment Bond for their portion of the Work, in conformity with the Form of Bonds shown in Sections 00 61 13.13 and 00 61 13.16.

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Bid Form

BIDDER:

_____

_____

_____

University of Maine **, University of Southern Maine**
c/o **Timothy Braun**
Building Construction Engineer
P. O. Box 9300, 25 Bedford Street, Portland, ME 04104-9300

Having carefully examined the form of contract, general conditions and plans and specifications contained therein for **Portland Central Heat Plant Upgrades- #2012-016**, as well as the premises and conditions affecting the work, we the undersigned propose to furnish all labor, equipment and materials necessary for and reasonably incidental to the construction and completion of this contract for the sum of _____ Dollars ($_____).

Alternate prices as follows:

Alternate #1 _____ Alternate #2 _____ Alternate #3 _____

This proposal includes the cost of 100% Performance Bond plus 100% Payment Bond.

The receipt of the following addenda to plans and specifications is hereby acknowledged:

ADDENDUM # ___ DATED _____ ADDENDUM # ___ DATED _____

ADDENDUM # ___ DATED _____ ADDENDUM # ___ DATED _____

Any material or materials not specified in the bidding document but worthy of consideration may be introduced by the bidder by a separate letter attached to this Proposal. A cost comparison must be included giving the comparison with the Material specified and the reason for the suggested substitution. The basic bid shall be as specified.

Filed Subcontract Bids as follows: (List those trades required, but do not combine trades except as called for).

Specification Division	*Subcontractor Name*	*Amount*
Plumbing: Division 22		
Mechanical: Division 23		
Electrical: Division 24		

The undersigned agrees that each of the above named Subcontractors represents a bona fide SubBid based on the Plans and Specifications and will be used for the Work indicated at the Amount stated, unless a substitution is made by mutual agreement as provided for in Section 00 22 13, "Supplemental Instruction to Bidders". In the event Alternate Prices are requested and various trades are involved, the General Contractor may use properly filed Sub-Bids even though a change in Subcontractors because of Alternates, the General Contractor shall use supplemental sheets attached to the Bid Form to indicate such changes.

The undersigned agrees, if this bid is accepted to sign a contract and deliver it, along with the bonds and affidavits for all insurance specified within twelve (12) calendar days after the date of notification of such acceptance, except if the 12th day falls on a Saturday, Sunday or holiday, then the conditions will be fulfilled if the required documents are received before 12 o'clock noon on the day following the holiday, or the Monday following the Saturday or Sunday, and as a guarantee thereof, herewith submits a bid bond as required.

The undersigned agrees, if awarded the Contract, to complete the work on or before September 1, 2015. The undersigned also agrees, if awarded the Contract, that no more than 80% of the contract amount will be sublet to other contractors.

Signed _____

By _____

Address _____

NOTE: If bidder is a corporation, write State of Incorporation, and if a partnership, give full names of all partners.

Maine Construction Bid Depository Subcontractor Bid Form

TO: _____

For green envelope copy, list any general contractor(s) excluded from your bid

PROJECT: _____

Section(s) Quoted: _____

Price Quoted: $_____ (written figures)

UNIT PRICES (if applicable)

Item _____ Amount $_____
Item _____ Amount $_____

A. The undersigned proposes to furnish all labor and materials required for completing in accordance with the hereinafter described plans, specifications, general conditions and addenda, all the work specified in the above stated section(s) of the specifications and contract drawings dated: _____

Prepared by: _____
Architect/Engineer

B. Alternate prices are submitted as follows: (Use separate sheets as necessary)

Alternate No. _____	Add $_____	Delete $_____
Alternate No. _____	Add $_____	Delete $_____
Alternate No. _____	Add $_____	Delete $_____
Alternate No. _____	Add $_____	Delete $_____

C. The subcontractor proposal includes the following addenda to the drawings and specifications: (List addenda and issue date of each)

Addendum No. _____	Dated _____
Addendum No. _____	Dated _____
Addendum No. _____	Dated _____
Addendum No. _____	Dated _____
Addendum No. _____	Dated _____

D. The undersigned agrees that if is selected as a Subcontractor, the Subcontractor will execute with the selected General Contractor a subcontract in accordance with the terms of the Subproposal, and

furnish the General Contractor with a 100% Performance Bond and a 100% Payment Bond for the Subcontractor's portion of the work.

E. License # (if applicable)

Company _____

Signed by _____ Date _____

Address _____
Street City St Zip

F. All foreign corporations intending to do business in Maine must comply with the provisions of 13A MRSA Chapter 12 and shall contact the Secretary of State for compliance.

Bid Security Form

KNOW ALL BY THESE PRESENTS, THAT WE, the undersigned, as PRINCIPAL _____ and _____ as SURETY, are hereby held and firmly bound unto the Treasurer of the UNIVERSITY OF MAINE SYSTEM in the penal sum of _____ 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 _____ day of _____, 20__.

The condition of the above obligation is such that whereas the Principal has submitted to _____ a certain proposal, attached hereto and hereby made a part hereof, to enter into a contract in writing for the _____.

NOW THEREFORE,

(a) If said proposal shall be rejected, or, in the alternate

(b) If said proposal 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 proposal) and shall furnish a bond for 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 proposal, 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 bond shall be in no way impaired or affected by any extension of the time within which the principal may accept such proposal, further said Surety does hereby waive notice of any such extension.

In the event suit is brought upon this bond by the Treasurer of the UNIVERSITY OF MAINE SYSTEM, Surety shall pay reasonable attorneys' fees and costs incurred by the Treasurer of the UNIVERSITY OF MAINE SYSTEM in such suit.

IN WITNESS WHEREOF, the Principal and 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.

_____
PRINCIPAL

By: _____
L.S.

_____
SURETY

_____
SURETY ADDRESS

By: _____
L.S.

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Subcontractors Bid Security Form

Know all by these presents that we, the undersigned, (1)_____ (2)_____ of _____ and State of _____, as Principal, and (3) _____, as Surety, are hereby held and firmly bound unto the Treasurer of the University of Maine System, as Owner, in the penal sum of _____ 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 (4)_____ day of _____, 20__.

The condition of the above obligation is such that whereas the Principal has submitted to the Owner a certain Sub-Bid, attached hereto and hereby made a part hereof, to enter into a subcontract in writing, for the construction of (5)_____ with any general contractor listed in said proposal, provided the designated general contractor has entered into a written contract with the Owner.

Now therefore:

a). If said Sub-Bid shall be rejected, or in the alternate,

b). If said Sub-Bid shall be accepted and the Principal shall execute and deliver a subcontract to the general contractor designated by the Owner in the form of subcontract which shall be in conformance with AIA Document A201 2007 General Conditions of the Contract, and University of Maine System 00 73 00 Supplementary Conditions to AIA A201 2007 General Conditions of the Contract for Construction for this project, and shall furnish bonds for 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 Sub-Bid, then this obligation shall be void, otherwise the same shall remain in force and effect: it is 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 bond shall in no way be impaired or affected by any extension of the time within which the principal may accept such proposal and said Surety does hereby waive notice of any such extension.

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 hereunto affixed and those presents to be signed by their proper officers, the day and year first set above.

SIGNED AND SEALED this (4)_____ day of _____, 20__.

WITNESS:		SUBCONTRACTOR:
_____	By LS	_____
_____	By LS	_____
_____	By LS	_____
WITNESS:		SURETY:
_____	By LS	_____
_____	By LS	_____
_____	By LS	_____

Legend
(1) Correct Name of Subcontractor
(2) A Corporation, A Partnership, or an Individual, as the case may be
(3) Correct Name of Surety
(4) Same date as that of Sub-Bid
(5) Name of Project as designated in Bidding Documents

If Subcontractor is Partnership, all Partners should execute Bond. A Power of Attorney document, together with a statement that it still is in full force and effect shall be provided by the person executing this Bond.

*** Date ***

*** Contractor ***
*** Address ***
*** City, State Zip ***

RE: Notice of Award *** Project Name and Campus ***

Dear *** Contractor Name ***:

You are hereby notified that the *** Campus *** acting on behalf of the University of Maine System accepts your Bid of **$* Total Amount including as statement as to any alternates that are included *** for the above named project, subject to final resolution of any bid protests and the parties' ability to establish and confirm final terms, as well as the execution of a written contract and your furnishing satisfactory bonds within twelve (12) calendar days as provided in the bidding documents.

This Notice of Award will permit you to proceed with the ordering of materials and scheduling the work so that the project can be completed on time. Should you fail to execute a contract or furnish satisfactory bonds within the stipulated time; the bid bond accompanying your proposal will be forfeited to the University of Maine System as liquidated damages.

Enclosed are three (3) originals of your contract agreement for signature. Further, please have your surety provide three (3) originals of the Performance Bond and the Payment Bond, as prescribed in Sections 00 61 13.13 and 00 61 13.16 of the bid document, and a properly executed "Power of Attorney." Please advise your surety agent that the bonds should carry the same date as this Notice of Award and the Contract Agreement. All copies of the signed contract, bonds and insurance certificates should be forwarded directly to this office. Once they are completely signed, a bound copy of the contract will be returned for your use.

Prior to your starting any work on the construction site, this office must receive Certificates of Liability Insurance as specified in Section Article 11 of AIA Document A201 – 2007 General Conditions of the Contract for Construction and Section 00 73 00.01 University of Maine System Supplemental Conditions. Please advise your surety that the certificate holder should be as follows: University of Maine System, 16 Central Street, Bangor, Maine 04401.

The day-to-day administrative and technical details of this project will be administered by the Project Manager. The Project Manager for this project is *** Project Manager's Name ***. All correspondence relative to the day-to-day administration of the project should be directed to *** Address *.**

A pre-construction conference on this project will be scheduled as soon as possible. This conference must be attended by your firm's authorized representative, as well as by your project superintendent.

Sincerely yours,

* Chief Financial Officer Name *
Chief Financial Officer

Enclosures

cc: UM System Office

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UNIVERSITY OF MAINE SYSTEM

Construction Contract Agreement

THIS AGREEMENT is made and entered into the _____ day of 20_____, by and between the Contractor * Contractor and Address * and the University of Maine System acting by and through the University of University of Southern Maine, P.O. Box 9300, Portland, ME 04104-9300.

WITNESSETH: That the Owner and the Contractor for the considerations hereinafter named agree as follows:

ARTICLE 1. SCOPE OF THE WORK

The Contractor shall furnish all of the materials and perform all of the work described in the Contract Documents entitled USM Central Heat Plant Upgrades, prepared by HARRIMAN dated October 31, 2014, acting as and in these Contract Documents entitled the Architect and/or Engineer.

ARTICLE 2: START AND TIME OF COMPLETION

The date of the commencement of work shall be the date of this Agreement or the following date _____ and shall be substantially completed on or before xx subject to adjustments as provided in the Contract Documents.

The Contractor and the Contractor's surety, if any, shall be liable for and shall pay the Owner the following stipulated liquidated damages for each calendar day of delay after the date established for Substantial Completion until the Work is substantially complete: One Thousand Two Hunderd and Fifty Dollars $1,250 per calendar day.

ARTICLE 3: THE CONTRACT SUM

The Owner shall pay the Contractor for the performance of the Contract as follows _____ Dollars $_____ subject to adjustments as provided in the Contract Documents

The Contract Sum is based upon the following alternatives and Unit Prices, if any, which are described in the Contract Documents and are hereby accepted by the Owner:

Alternate (1) _____ Alternate (2) _____ Alternate (3) _____

Unit Prices

Item _____ Price _____

Item _____ Price _____

Final payment shall be made after completion and acceptance of the work as provided in the Contract Documents.

ARTICLE 4: THE CONTRACT DOCUMENTS

The Contract Documents for this project, except for modifications issued after execution of this agreement, consist of:

.1 This agreement.

.2 AIA Document A201-2007, General Conditions of the Contract for Construction, as modified by University of Maine System 00 73 00.01 Supplementary Conditions to A201-2007.

.3 The Specifications as outlined in the Project Manual (USM Central Heat Plant Boiler Replacement dated October 24, 2014).

.4 The Drawings as listed in the Project Manual.

.5 The Addenda (List the addenda and dates issued).

.6 Other documents if any (List any other documents that are intended to be part of the Contract)

ARTICLE 5: OWNER'S REPRESENTATIVES

The Owner's Representative on this project will be Robert Bertram, who is authorized to sign contracts and other legal documents related to this project on behalf of the Owner.

The Owner's Project Manager on this project will be Tim Braun.

The Owner and the Contractor hereby agree to the full performance of the covenants herein.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement in triplicate on the day and year first above written.

UNIVERSITY OF MAINE SYSTEM	
Company	Company
By:	By:
Robert Bertram Executive Director of Facilities Management University of Maine , University of Southern Maine	Title
Witness	Witness

Performance Bond Form
Bond No. _____

KNOW ALL BY THESE PRESENTS THAT (1)_____ (2)_____ of _____ and State of _____, as PRINCIPAL, and (3) _____, a corporation duly organized under the laws of the State of _____ and having a usual place of business in _____, as SURETY, are held and firmly bound unto the University of Maine System in the sum of _____ Dollars ($_____), to be paid said Treasurer of the University of Maine System, or successor in office, for which payment well and truly to be made, Principal and Surety bind themselves, their heirs, executors and administrators, successors and assigns, jointly and severally by these presents.

The condition of this obligation is such that if the Principal shall promptly and faithfully perform the Contract entered into on the (4)_____ day of _____, A.D., 20_____for the construction of (5)_____ then this obligation shall be null and void; otherwise, it shall remain in full force and effect.

The Surety hereby waives notice of any alteration or extension of time made by the University of Maine System.

Signed and sealed this (4)_____ day of _____, 20_____.

WITNESSES:	SIGNATURES:	
_____	_____	LS
_____	_____	LS
_____	_____	LS

Bonding Company Agent:

Company:	_____
Street:	_____
City, State, Zip:	_____
Telephone:	_____

(1.) Correct name of Contractor
(2.) A corporation, a partnership, or an individual, as the case may be.
(3.) Correct name of Surety
(4.) Same date as that of contract.
(5.) Name of Project as designated in contract.

If Contractor is partnership, all partners should execute bond. A Power of Attorney document, together with a statement that it still is in effect shall be provided by the person executing this bond. Bond must be countersigned by a Resident Maine Agent.

****DO NOT ALTER LANGUAGE****

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Payment Bond Form
Bond No. _____

KNOW ALL BY THESE PRESENTS THAT (1)_____ (2)_____ of _____ and State of _____, as Principal, and (3)_____, a corporation duly organized under the laws of the State of _____, and having a usual place of business in _____, as Surety, are held and firmly bound unto the University of Maine System in the sum of _____ Dollars ($_____) for the use and benefit of claimants* as herein below defined, for the payment whereof Principal and Surety bind themselves, their heirs, executors and administrators, successors and assigns, jointly and severally by these presents.

The condition of this 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 contemplated in the Contract entered into on the (4)_____ day of _____, A.D., 20_____, for the construction of (5)_____, and shall fully reimburse the obligee for all outlay and expense which said obligee may incur in making good any default of said principal, then this obligation shall be null and void; otherwise, it shall remain in full force and effect.

*A Claimant is defined as one having a direct contract with the Principal or with a subcontractor of the Principal for labor, material, or both, used or reasonably required for use in the performance of the contract.

Signed and sealed this (6)_____ day of _____, 20_____.

WITNESS: SIGNATURES"

_____ By LS _____

_____ By LS _____

_____ By LS _____

Bonding Company Agent:

Company: _____

Street: _____

City, State, Zip: _____

Telephone: _____

(1.) Correct name of Contractor
(2.) A corporation, a partnership, or an individual, as the case may be.
(3.) Correct name of Surety
(4.) Same date as that of contract.
(5.) Name of Project as designated in contract.
(6.) Same date as that of Contract.

If contractor is partnership, all partners should execute bond.
A Power of Attorney document, together with a statement that it still is in effect shall be provided by the person executing this bond.
Bond must be countersigned by a Resident Maine Agent.

****DO NOT ALTER LANGUAGE****

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AIA® Document G715™ – 1991

Supplemental Attachment for ACORD Certificate of Insurance 25-S

(This document replaces AIA Document G705, Certificate of Insurance.)

PROJECT *(Name and address)*:

INSURED UNIVERSITY OF MAINE SYSTEM
16 Central Street, Bangor, ME 04401

		Yes	No	N/A
A.	**General Liability**			
1.	Does the General Aggregate apply to this Project only?	☐	☐	☐
2.	Does this policy include coverage for:			
a.	Premises - Operations?	☐	☐	☐
b.	Explosion, Collapse and Underground Hazards?	☐	☐	☐
c.	Personal Injury Coverage?	☐	☐	☐
d.	Products Coverage?	☐	☐	☐
e.	Completed Operations?	☐	☐	☐
f.	Contractual Coverage for the Insured's obligations in A201?	☐	☐	☐
3.	If coverage is written on a claims-made basis, what is the:			
a.	Retroactive Date?			
b.	Extended Reporting Date?			
B.	**Worker's Compensation**			
1.	If the Insured is exempt from Worker's Compensation statutes, does the Insured carry the equivalent Voluntary Compensation coverage?	☐	☐	☐
C.	**Final Payment Information**			
1.	Is this certificate being furnished in connection with the Contractor's request for final payment in accordance with the requirements of Sections 9.10.2 and 11.1.3 of AIA Document A201, General Conditions of the Contract for Construction?	☐	☐	☐
2.	If so, and if the policy period extends beyond termination of the Contract for Construction, is Completed Operations coverage for this Project continued for the balance of the policy period?	☐	☐	☐
D.	**Termination Provisions**			
1.	Has each policy shown on the certificate and this Supplement been endorsed to provide the holder with 30 days notice of cancellation and/or expiration? List below any policies which do not contain this notice.	☐	☐	☐
E.	**Other Provisions**			

Authorized Representative

Date of Issue

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ACORD™ CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YY)

PRODUCER

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW.

INSURERS AFFORDING COVERAGE

INSURED

INSURER A:
INSURER B:
INSURER C:
INSURER D:
INSURER E:

COVERAGES

THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. AGGREGATE LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE (MM/DD/YY)	POLICY EXPIRATION DATE (MM/DD/YY)	LIMITS	
	GENERAL LIABILITY				EACH OCCURRENCE	$
	☐ COMMERCIAL GENERAL LIABILITY				FIRE DAMAGE (Any one fire)	$
	☐ CLAIMS MADE ☐ OCCUR				MED EXP (Any one person)	$
	_____				PERSONAL & ADV INJURY	$
	_____				GENERAL AGGREGATE	$
	GEN'L AGGREGATE LIMIT APPLIES PER:				PRODUCTS - COMP/OP AGG	$
	☐ POLICY ☐ PRO-JECT ☐ LOC					
	AUTOMOBILE LIABILITY				COMBINED SINGLE LIMIT (Ea accident)	$
	☐ ANY AUTO					
	☐ ALL OWNED AUTOS				BODILY INJURY (Per person)	$
	☐ SCHEDULED AUTOS					
	☐ HIRED AUTOS				BODILY INJURY (Per accident)	$
	☐ NON-OWNED AUTOS					
	_____				PROPERTY DAMAGE (Per accident)	$
	GARAGE LIABILITY				AUTO ONLY - EA ACCIDENT	$
	☐ ANY AUTO				OTHER THAN AUTO ONLY: EA ACC	$
					AGG	$
	EXCESS LIABILITY				EACH OCCURRENCE	$
	☐ OCCUR ☐ CLAIMS MADE				AGGREGATE	$
						$
	☐ DEDUCTIBLE					$
	☐ RETENTION $					$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY				☐ WC STATU-TORY LIMITS ☐ OTH-ER	
					E.L. EACH ACCIDENT	$
					E.L. DISEASE - EA EMPLOYEE	$
					E.L. DISEASE - POLICY LIMIT	$
	OTHER					

DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES/EXCLUSIONS ADDED BY ENDORSEMENT/SPECIAL PROVISIONS

CERTIFICATE HOLDER

☐ ADDITIONAL INSURED; INSURER LETTER: ____

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING INSURER WILL ENDEAVOR TO MAIL _____ DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER NAMED TO THE LEFT, BUT FAILURE TO DO SO SHALL IMPOSE NO OBLIGATION OR LIABILITY OF ANY KIND UPON THE INSURER, ITS AGENTS OR REPRESENTATIVES.

AUTHORIZED REPRESENTATIVE

IMPORTANT

If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

DISCLAIMER

The Certificate of Insurance on the reverse side of this form does not constitute a contract between the issuing insurer(s), authorized representative or producer, and the certificate holder, nor does it affirmatively or negatively amend, extend or alter the coverage afforded by the policies listed thereon.

COMMERCIAL GENERAL LIABILITY COVERAGE FORM

Various provisions in this policy restrict coverage. Read the entire policy carefully to determine rights, duties and what is and is not covered.

Throughout this policy the words "you" and "your" refer to the Named Insured shown in the Declarations, and any other person or organization qualifying as a Named Insured under this policy. The words "we", "us" and "our" refer to the company providing this insurance.

The word "insured" means any person or organization qualifying as such under Section **II** – Who Is An Insured.

Other words and phrases that appear in quotation marks have special meaning. Refer to Section **V** – Definitions.

SECTION I – COVERAGES

COVERAGE A BODILY INJURY AND PROPERTY DAMAGE LIABILITY

1. Insuring Agreement

a. We will pay those sums that the insured becomes legally obligated to pay as damages because of "bodily injury" or "property damage" to which this insurance applies. We will have the right and duty to defend the insured against any "suit" seeking those damages. However, we will have no duty to defend the insured against any "suit" seeking damages for "bodily injury" or "property damage" to which this insurance does not apply. We may, at our discretion, investigate any "occurrence" and settle any claim or "suit" that may result. But:

(1) The amount we will pay for damages is limited as described in Section **III** – Limits Of Insurance; and

(2) Our right and duty to defend ends when we have used up the applicable limit of insurance in the payment of judgments or settlements under Coverages **A** or **B** or medical expenses under Coverage **C.**

No other obligation or liability to pay sums or perform acts or services is covered unless explicitly provided for under Supplementary Payments – Coverages **A** and **B.**

b. This insurance applies to "bodily injury" and "property damage" only if:

(1) The "bodily injury" or "property damage" is caused by an "occurrence" that takes place in the "coverage territory";

(2) The "bodily injury" or "property damage" occurs during the policy period; and

(3) Prior to the policy period, no insured listed under Paragraph **1.** of Section **II** – Who Is An Insured and no "employee" authorized by you to give or receive notice of an "occurrence" or claim, knew that the "bodily injury" or "property damage" had occurred, in whole or in part. If such a listed insured or authorized "employee" knew, prior to the policy period, that the "bodily injury" or "property damage" occurred, then any continuation, change or resumption of such "bodily injury" or "property damage" during or after the policy period will be deemed to have been known prior to the policy period.

c. "Bodily injury" or "property damage" which occurs during the policy period and was not, prior to the policy period, known to have occurred by any insured listed under Paragraph **1.** of Section **II** – Who Is An Insured or any "employee" authorized by you to give or receive notice of an "occurrence" or claim, includes any continuation, change or resumption of that "bodily injury" or "property damage" after the end of the policy period.

d. "Bodily injury" or "property damage" will be deemed to have been known to have occurred at the earliest time when any insured listed under Paragraph **1.** of Section **II** – Who Is An Insured or any "employee" authorized by you to give or receive notice of an "occurrence" or claim:

(1) Reports all, or any part, of the "bodily injury" or "property damage" to us or any other insurer;

(2) Receives a written or verbal demand or claim for damages because of the "bodily injury" or "property damage"; or

(3) Becomes aware by any other means that "bodily injury" or "property damage" has occurred or has begun to occur.

e. Damages because of "bodily injury" include damages claimed by any person or organization for care, loss of services or death resulting at any time from the "bodily injury".

2. Exclusions

This insurance does not apply to:

a. Expected Or Intended Injury

"Bodily injury" or "property damage" expected or intended from the standpoint of the insured. This exclusion does not apply to "bodily injury" resulting from the use of reasonable force to protect persons or property.

b. Contractual Liability

"Bodily injury" or "property damage" for which the insured is obligated to pay damages by reason of the assumption of liability in a contract or agreement. This exclusion does not apply to liability for damages:

(1) That the insured would have in the absence of the contract or agreement; or

(2) Assumed in a contract or agreement that is an "insured contract", provided the "bodily injury" or "property damage" occurs subsequent to the execution of the contract or agreement. Solely for the purposes of liability assumed in an "insured contract", reasonable attorney fees and necessary litigation expenses incurred by or for a party other than an insured are deemed to be damages because of "bodily injury" or "property damage", provided:

(a) Liability to such party for, or for the cost of, that party's defense has also been assumed in the same "insured contract"; and

(b) Such attorney fees and litigation expenses are for defense of that party against a civil or alternative dispute resolution proceeding in which damages to which this insurance applies are alleged.

c. Liquor Liability

"Bodily injury" or "property damage" for which any insured may be held liable by reason of:

(1) Causing or contributing to the intoxication of any person;

(2) The furnishing of alcoholic beverages to a person under the legal drinking age or under the influence of alcohol; or

(3) Any statute, ordinance or regulation relating to the sale, gift, distribution or use of alcoholic beverages.

This exclusion applies only if you are in the business of manufacturing, distributing, selling, serving or furnishing alcoholic beverages.

d. Workers' Compensation And Similar Laws

Any obligation of the insured under a workers' compensation, disability benefits or unemployment compensation law or any similar law.

e. Employer's Liability

"Bodily injury" to:

(1) An "employee" of the insured arising out of and in the course of:

(a) Employment by the insured; or

(b) Performing duties related to the conduct of the insured's business; or

(2) The spouse, child, parent, brother or sister of that "employee" as a consequence of Paragraph **(1)** above.

This exclusion applies:

(1) Whether the insured may be liable as an employer or in any other capacity; and

(2) To any obligation to share damages with or repay someone else who must pay damages because of the injury.

This exclusion does not apply to liability assumed by the insured under an "insured contract".

f. Pollution

(1) "Bodily injury" or "property damage" arising out of the actual, alleged or threatened discharge, dispersal, seepage, migration, release or escape of "pollutants":

(a) At or from any premises, site or location which is or was at any time owned or occupied by, or rented or loaned to, any insured. However, this subparagraph does not apply to:

(i) "Bodily injury" if sustained within a building and caused by smoke, fumes, vapor or soot produced by or originating from equipment that is used to heat, cool or dehumidify the building, or equipment that is used to heat water for personal use, by the building's occupants or their guests;

(ii) "Bodily injury" or "property damage" for which you may be held liable, if you are a contractor and the owner or lessee of such premises, site or location has been added to your policy as an additional insured with respect to your ongoing operations performed for that additional insured at that premises, site or location and such premises, site or location is not and never was owned or occupied by, or rented or loaned to, any insured, other than that additional insured; or

(iii) "Bodily injury" or "property damage" arising out of heat, smoke or fumes from a "hostile fire";

(b) At or from any premises, site or location which is or was at any time used by or for any insured or others for the handling, storage, disposal, processing or treatment of waste;

(c) Which are or were at any time transported, handled, stored, treated, disposed of, or processed as waste by or for:

(i) Any insured; or

(ii) Any person or organization for whom you may be legally responsible; or

(d) At or from any premises, site or location on which any insured or any contractors or subcontractors working directly or indirectly on any insured's behalf are performing operations if the "pollutants" are brought on or to the premises, site or location in connection with such operations by such insured, contractor or subcontractor. However, this subparagraph does not apply to:

(i) "Bodily injury" or "property damage" arising out of the escape of fuels, lubricants or other operating fluids which are needed to perform the normal electrical, hydraulic or mechanical functions necessary for the operation of "mobile equipment" or its parts, if such fuels, lubricants or other operating fluids escape from a vehicle part designed to hold, store or receive them. This exception does not apply if the "bodily injury" or "property damage" arises out of the intentional discharge, dispersal or release of the fuels, lubricants or other operating fluids, or if such fuels, lubricants or other operating fluids are brought on or to the premises, site or location with the intent that they be discharged, dispersed or released as part of the operations being performed by such insured, contractor or subcontractor;

(ii) "Bodily injury" or "property damage" sustained within a building and caused by the release of gases, fumes or vapors from materials brought into that building in connection with operations being performed by you or on your behalf by a contractor or subcontractor; or

(iii) "Bodily injury" or "property damage" arising out of heat, smoke or fumes from a "hostile fire".

(e) At or from any premises, site or location on which any insured or any contractors or subcontractors working directly or indirectly on any insured's behalf are performing operations if the operations are to test for, monitor, clean up, remove, contain, treat, detoxify or neutralize, or in any way respond to, or assess the effects of, "pollutants".

(2) Any loss, cost or expense arising out of any:

(a) Request, demand, order or statutory or regulatory requirement that any insured or others test for, monitor, clean up, remove, contain, treat, detoxify or neutralize, or in any way respond to, or assess the effects of, "pollutants"; or

(b) Claim or "suit" by or on behalf of a governmental authority for damages because of testing for, monitoring, cleaning up, removing, containing, treating, detoxifying or neutralizing, or in any way responding to, or assessing the effects of, "pollutants".

However, this paragraph does not apply to liability for damages because of "property damage" that the insured would have in the absence of such request, demand, order or statutory or regulatory requirement, or such claim or "suit" by or on behalf of a governmental authority.

g. Aircraft, Auto Or Watercraft

"Bodily injury" or "property damage" arising out of the ownership, maintenance, use or entrustment to others of any aircraft, "auto" or watercraft owned or operated by or rented or loaned to any insured. Use includes operation and "loading or unloading".

This exclusion applies even if the claims against any insured allege negligence or other wrongdoing in the supervision, hiring, employment, training or monitoring of others by that insured, if the "occurrence" which caused the "bodily injury" or "property damage" involved the ownership, maintenance, use or entrustment to others of any aircraft, "auto" or watercraft that is owned or operated by or rented or loaned to any insured.

This exclusion does not apply to:

(1) A watercraft while ashore on premises you own or rent;

(2) A watercraft you do not own that is:

(a) Less than 26 feet long; and

(b) Not being used to carry persons or property for a charge;

(3) Parking an "auto" on, or on the ways next to, premises you own or rent, provided the "auto" is not owned by or rented or loaned to you or the insured;

(4) Liability assumed under any "insured contract" for the ownership, maintenance or use of aircraft or watercraft; or

(5) "Bodily injury" or "property damage" arising out of:

(a) The operation of machinery or equipment that is attached to, or part of, a land vehicle that would qualify under the definition of "mobile equipment" if it were not subject to a compulsory or financial responsibility law or other motor vehicle insurance law in the state where it is licensed or principally garaged; or

(b) the operation of any of the machinery or equipment listed in Paragraph **f.(2)** or **f.(3)** of the definition of "mobile equipment".

h. Mobile Equipment

"Bodily injury" or "property damage" arising out of:

(1) The transportation of "mobile equipment" by an "auto" owned or operated by or rented or loaned to any insured; or

(2) The use of "mobile equipment" in, or while in practice for, or while being prepared for, any prearranged racing, speed, demolition, or stunting activity.

i. War

"Bodily injury" or "property damage", however caused, arising, directly or indirectly, out of:

(1) War, including undeclared or civil war;

(2) Warlike action by a military force, including action in hindering or defending against an actual or expected attack, by any government, sovereign or other authority using military personnel or other agents; or

(3) Insurrection, rebellion, revolution, usurped power, or action taken by governmental authority in hindering or defending against any of these.

j. Damage To Property

"Property damage" to:

(1) Property you own, rent, or occupy, including any costs or expenses incurred by you, or any other person, organization or entity, for repair, replacement, enhancement, restoration or maintenance of such property for any reason, including prevention of injury to a person or damage to another's property;

(2) Premises you sell, give away or abandon, if the "property damage" arises out of any part of those premises;

(3) Property loaned to you;

(4) Personal property in the care, custody or control of the insured;

(5) That particular part of real property on which you or any contractors or subcontractors working directly or indirectly on your behalf are performing operations, if the "property damage" arises out of those operations; or

(6) That particular part of any property that must be restored, repaired or replaced because "your work" was incorrectly performed on it.

Paragraphs **(1), (3)** and **(4)** of this exclusion do not apply to "property damage" (other than damage by fire) to premises, including the contents of such premises, rented to you for a period of 7 or fewer consecutive days. A separate limit of insurance applies to Damage To Premises Rented To You as described in Section **III** – Limits Of Insurance.

Paragraph **(2)** of this exclusion does not apply if the premises are "your work" and were never occupied, rented or held for rental by you.

Paragraphs **(3), (4), (5)** and **(6)** of this exclusion do not apply to liability assumed under a sidetrack agreement.

Paragraph **(6)** of this exclusion does not apply to "property damage" included in the "products-completed operations hazard".

k. Damage To Your Product

"Property damage" to "your product" arising out of it or any part of it.

l. Damage To Your Work

"Property damage" to "your work" arising out of it or any part of it and included in the "products-completed operations hazard".

This exclusion does not apply if the damaged work or the work out of which the damage arises was performed on your behalf by a subcontractor.

m. Damage To Impaired Property Or Property Not Physically Injured

"Property damage" to "impaired property" or property that has not been physically injured, arising out of:

(1) A defect, deficiency, inadequacy or dangerous condition in "your product" or "your work"; or

(2) A delay or failure by you or anyone acting on your behalf to perform a contract or agreement in accordance with its terms.

This exclusion does not apply to the loss of use of other property arising out of sudden and accidental physical injury to "your product" or "your work" after it has been put to its intended use.

n. Recall Of Products, Work Or Impaired Property

Damages claimed for any loss, cost or expense incurred by you or others for the loss of use, withdrawal, recall, inspection, repair, replacement, adjustment, removal or disposal of:

(1) "Your product";

(2) "Your work"; or

(3) "Impaired property";

if such product, work, or property is withdrawn or recalled from the market or from use by any person or organization because of a known or suspected defect, deficiency, inadequacy or dangerous condition in it.

o. Personal And Advertising Injury

"Bodily injury" arising out of "personal and advertising injury".

p. Electronic Data

Damages arising out of the loss of, loss of use of, damage to, corruption of, inability to access, or inability to manipulate electronic data.

As used in this exclusion, electronic data means information, facts or programs stored as or on, created or used on, or transmitted to or from computer software, including systems and applications software, hard or floppy disks, CD-ROMS, tapes, drives, cells, data processing devices or any other media which are used with electronically controlled equipment.

Exclusions **c.** through **n.** do not apply to damage by fire to premises while rented to you or temporarily occupied by you with permission of the owner. A separate limit of insurance applies to this coverage as described in Section **III** – Limits Of Insurance.

COVERAGE B PERSONAL AND ADVERTISING INJURY LIABILITY

1. Insuring Agreement

a. We will pay those sums that the insured becomes legally obligated to pay as damages because of "personal and advertising injury" to which this insurance applies. We will have the right and duty to defend the insured against any "suit" seeking those damages. However, we will have no duty to defend the insured against any "suit" seeking damages for "personal and advertising injury" to which this insurance does not apply. We may, at our discretion, investigate any offense and settle any claim or "suit" that may result. But:

(1) The amount we will pay for damages is limited as described in Section **III** – Limits Of Insurance; and

(2) Our right and duty to defend end when we have used up the applicable limit of insurance in the payment of judgments or settlements under Coverages **A** or **B** or medical expenses under Coverage **C.**

No other obligation or liability to pay sums or perform acts or services is covered unless explicitly provided for under Supplementary Payments – Coverages **A** and **B.**

b. This insurance applies to "personal and advertising injury" caused by an offense arising out of your business but only if the offense was committed in the "coverage territory" during the policy period.

2. Exclusions

This insurance does not apply to:

a. Knowing Violation Of Rights Of Another

"Personal and advertising injury" caused by or at the direction of the insured with the knowledge that the act would violate the rights of another and would inflict "personal and advertising injury".

b. Material Published With Knowledge Of Falsity

"Personal and advertising injury" arising out of oral or written publication of material, if done by or at the direction of the insured with knowledge of its falsity.

c. Material Published Prior To Policy Period

"Personal and advertising injury" arising out of oral or written publication of material whose first publication took place before the beginning of the policy period.

d. Criminal Acts

"Personal and advertising injury" arising out of a criminal act committed by or at the direction of the insured.

e. Contractual Liability

"Personal and advertising injury" for which the insured has assumed liability in a contract or agreement. This exclusion does not apply to liability for damages that the insured would have in the absence of the contract or agreement.

f. Breach Of Contract

"Personal and advertising injury" arising out of a breach of contract, except an implied contract to use another's advertising idea in your "advertisement".

g. Quality Or Performance Of Goods – Failure To Conform To Statements

"Personal and advertising injury" arising out of the failure of goods, products or services to conform with any statement of quality or performance made in your "advertisement".

h. Wrong Description Of Prices

"Personal and advertising injury" arising out of the wrong description of the price of goods, products or services stated in your "advertisement".

i. Infringement Of Copyright, Patent, Trademark Or Trade Secret

"Personal and advertising injury" arising out of the infringement of copyright, patent, trademark, trade secret or other intellectual property rights.

However, this exclusion does not apply to infringement, in your "advertisement", of copyright, trade dress or slogan.

j. Insureds In Media And Internet Type Businesses

"Personal and advertising injury" committed by an insured whose business is:

(1) Advertising, broadcasting, publishing or telecasting;

(2) Designing or determining content of websites for others; or

(3) An Internet search, access, content or service provider.

However, this exclusion does not apply to Paragraphs **14.a., b.** and **c.** of "personal and advertising injury" under the Definitions Section.

For the purposes of this exclusion, the placing of frames, borders or links, or advertising, for you or others anywhere on the Internet, is not by itself, considered the business of advertising, broadcasting, publishing or telecasting.

k. Electronic Chatrooms Or Bulletin Boards

"Personal and advertising injury" arising out of an electronic chatroom or bulletin board the insured hosts, owns, or over which the insured exercises control.

l. Unauthorized Use Of Another's Name Or Product

"Personal and advertising injury" arising out of the unauthorized use of another's name or product in your e-mail address, domain name or metatag, or any other similar tactics to mislead another's potential customers.

m. Pollution

"Personal and advertising injury" arising out of the actual, alleged or threatened discharge, dispersal, seepage, migration, release or escape of "pollutants" at any time.

n. Pollution-Related

Any loss, cost or expense arising out of any:

(1) Request, demand, order or statutory or regulatory requirement that any insured or others test for, monitor, clean up, remove, contain, treat, detoxify or neutralize, or in any way respond to, or assess the effects of, "pollutants"; or

(2) Claim or suit by or on behalf of a governmental authority for damages because of testing for, monitoring, cleaning up, removing, containing, treating, detoxifying or neutralizing, or in any way responding to, or assessing the effects of, "pollutants".

o. War

"Personal and advertising injury", however caused, arising, directly or indirectly, out of:

(1) War, including undeclared or civil war;

(2) Warlike action by a military force, including action in hindering or defending against an actual or expected attack, by any government, sovereign or other authority using military personnel or other agents; or

(3) Insurrection, rebellion, revolution, usurped power, or action taken by governmental authority in hindering or defending against any of these.

COVERAGE C MEDICAL PAYMENTS

1. Insuring Agreement

a. We will pay medical expenses as described below for "bodily injury" caused by an accident:

(1) On premises you own or rent;

(2) On ways next to premises you own or rent; or

(3) Because of your operations;

provided that:

(1) The accident takes place in the "coverage territory" and during the policy period;

(2) The expenses are incurred and reported to us within one year of the date of the accident; and

(3) The injured person submits to examination, at our expense, by physicians of our choice as often as we reasonably require.

b. We will make these payments regardless of fault. These payments will not exceed the applicable limit of insurance. We will pay reasonable expenses for:

(1) First aid administered at the time of an accident;

(2) Necessary medical, surgical, x-ray and dental services, including prosthetic devices; and

(3) Necessary ambulance, hospital, professional nursing and funeral services.

2. Exclusions

We will not pay expenses for "bodily injury":

a. Any Insured

To any insured, except "volunteer workers".

b. Hired Person

To a person hired to do work for or on behalf of any insured or a tenant of any insured.

c. Injury On Normally Occupied Premises

To a person injured on that part of premises you own or rent that the person normally occupies.

d. Workers Compensation And Similar Laws

To a person, whether or not an "employee" of any insured, if benefits for the "bodily injury" are payable or must be provided under a workers' compensation or disability benefits law or a similar law.

e. Athletics Activities

To a person injured while practicing, instructing or participating in any physical exercises or games, sports, or athletic contests.

f. Products-Completed Operations Hazard

Included within the "products-completed operations hazard".

g. Coverage A Exclusions

Excluded under Coverage **A.**

SUPPLEMENTARY PAYMENTS – COVERAGES A AND B

1. We will pay, with respect to any claim we investigate or settle, or any "suit" against an insured we defend:

a. All expenses we incur.

b. Up to $250 for cost of bail bonds required because of accidents or traffic law violations arising out of the use of any vehicle to which the Bodily Injury Liability Coverage applies. We do not have to furnish these bonds.

c. The cost of bonds to release attachments, but only for bond amounts within the applicable limit of insurance. We do not have to furnish these bonds.

d. All reasonable expenses incurred by the insured at our request to assist us in the investigation or defense of the claim or "suit", including actual loss of earnings up to $250 a day because of time off from work.

e. All costs taxed against the insured in the "suit".

f. Prejudgment interest awarded against the insured on that part of the judgment we pay. If we make an offer to pay the applicable limit of insurance, we will not pay any prejudgment interest based on that period of time after the offer.

g. All interest on the full amount of any judgment that accrues after entry of the judgment and before we have paid, offered to pay, or deposited in court the part of the judgment that is within the applicable limit of insurance.

These payments will not reduce the limits of insurance.

2. If we defend an insured against a "suit" and an indemnitee of the insured is also named as a party to the "suit", we will defend that indemnitee if all of the following conditions are met:

a. The "suit" against the indemnitee seeks damages for which the insured has assumed the liability of the indemnitee in a contract or agreement that is an "insured contract";

b. This insurance applies to such liability assumed by the insured;

c. The obligation to defend, or the cost of the defense of, that indemnitee, has also been assumed by the insured in the same "insured contract";

d. The allegations in the "suit" and the information we know about the "occurrence" are such that no conflict appears to exist between the interests of the insured and the interests of the indemnitee;

e. The indemnitee and the insured ask us to conduct and control the defense of that indemnitee against such "suit" and agree that we can assign the same counsel to defend the insured and the indemnitee; and

f. The indemnitee:

(1) Agrees in writing to:

(a) Cooperate with us in the investigation, settlement or defense of the "suit";

(b) Immediately send us copies of any demands, notices, summonses or legal papers received in connection with the "suit";

(c) Notify any other insurer whose coverage is available to the indemnitee; and

(d) Cooperate with us with respect to coordinating other applicable insurance available to the indemnitee; and

(2) Provides us with written authorization to:

(a) Obtain records and other information related to the "suit"; and

(b) Conduct and control the defense of the indemnitee in such "suit".

So long as the above conditions are met, attorneys' fees incurred by us in the defense of that indemnitee, necessary litigation expenses incurred by us and necessary litigation expenses incurred by the indemnitee at our request will be paid as Supplementary Payments. Notwithstanding the provisions of Paragraph **2.b.(2)** of Section **I** – Coverage **A** – Bodily Injury And Property Damage Liability, such payments will not be deemed to be damages for "bodily injury" and "property damage" and will not reduce the limits of insurance.

Our obligation to defend an insured's indemnitee and to pay for attorneys' fees and necessary litigation expenses as Supplementary Payments ends when:

a. We have used up the applicable limit of insurance in the payment of judgments or settlements; or

b. The conditions set forth above, or the terms of the agreement described in Paragraph **f.** above, are no longer met.

SECTION II – WHO IS AN INSURED

1. If you are designated in the Declarations as:

a. An individual, you and your spouse are insureds, but only with respect to the conduct of a business of which you are the sole owner.

b. A partnership or joint venture, you are an insured. Your members, your partners, and their spouses are also insureds, but only with respect to the conduct of your business.

c. A limited liability company, you are an insured. Your members are also insureds, but only with respect to the conduct of your business. Your managers are insureds, but only with respect to their duties as your managers.

d. An organization other than a partnership, joint venture or limited liability company, you are an insured. Your "executive officers" and directors are insureds, but only with respect to their duties as your officers or directors. Your stockholders are also insureds, but only with respect to their liability as stockholders.

e. A trust, you are an insured. Your trustees are also insureds, but only with respect to their duties as trustees.

2. Each of the following is also an insured:

a. Your "volunteer workers" only while performing duties related to the conduct of your business, or your "employees", other than either your "executive officers" (if you are an organization other than a partnership, joint venture or limited liability company) or your managers (if you are a limited liability company), but only for acts within the scope of their employment by you or while performing duties related to the conduct of your business. However, none of these "employees" or "volunteer workers" are insureds for:

(1) "Bodily injury" or "personal and advertising injury":

(a) To you, to your partners or members (if you are a partnership or joint venture), to your members (if you are a limited liability company), to a co-"employee" while in the course of his or her employment or performing duties related to the conduct of your business, or to your other "volunteer workers" while performing duties related to the conduct of your business;

(b) To the spouse, child, parent, brother or sister of that co-"employee" or "volunteer worker" as a consequence of Paragraph **(1)(a)** above;

(c) For which there is any obligation to share damages with or repay someone else who must pay damages because of the injury described in Paragraphs **(1)(a)** or **(b)** above; or

(d) Arising out of his or her providing or failing to provide professional health care services.

(2) "Property damage" to property:

(a) Owned, occupied or used by,

(b) Rented to, in the care, custody or control of, or over which physical control is being exercised for any purpose by

you, any of your "employees", "volunteer workers", any partner or member (if you are a partnership or joint venture), or any member (if you are a limited liability company).

b. Any person (other than your "employee" or "volunteer worker"), or any organization while acting as your real estate manager.

c. Any person or organization having proper temporary custody of your property if you die, but only:

(1) With respect to liability arising out of the maintenance or use of that property; and

(2) Until your legal representative has been appointed.

d. Your legal representative if you die, but only with respect to duties as such. That representative will have all your rights and duties under this Coverage Part.

3. Any organization you newly acquire or form, other than a partnership, joint venture or limited liability company, and over which you maintain ownership or majority interest, will qualify as a Named Insured if there is no other similar insurance available to that organization. However:

a. Coverage under this provision is afforded only until the 90th day after you acquire or form the organization or the end of the policy period, whichever is earlier;

b. Coverage **A** does not apply to "bodily injury" or "property damage" that occurred before you acquired or formed the organization; and

c. Coverage **B** does not apply to "personal and advertising injury" arising out of an offense committed before you acquired or formed the organization.

No person or organization is an insured with respect to the conduct of any current or past partnership, joint venture or limited liability company that is not shown as a Named Insured in the Declarations.

SECTION III – LIMITS OF INSURANCE

1. The Limits of Insurance shown in the Declarations and the rules below fix the most we will pay regardless of the number of:

a. Insureds;

b. Claims made or "suits" brought; or

c. Persons or organizations making claims or bringing "suits".

2. The General Aggregate Limit is the most we will pay for the sum of:

a. Medical expenses under Coverage **C;**

b. Damages under Coverage **A,** except damages because of "bodily injury" or "property damage" included in the "products-completed operations hazard"; and

c. Damages under Coverage **B.**

3. The Products-Completed Operations Aggregate Limit is the most we will pay under Coverage **A** for damages because of "bodily injury" and "property damage" included in the "products-completed operations hazard".

4. Subject to **2.** above, the Personal and Advertising Injury Limit is the most we will pay under Coverage **B** for the sum of all damages because of all "personal and advertising injury" sustained by any one person or organization.

5. Subject to **2.** or **3.** above, whichever applies, the Each Occurrence Limit is the most we will pay for the sum of:

a. Damages under Coverage **A;** and

b. Medical expenses under Coverage **C**

because of all "bodily injury" and "property damage" arising out of any one "occurrence".

6. Subject to **5.** above, the Damage To Premises Rented To You Limit is the most we will pay under Coverage **A** for damages because of "property damage" to any one premises, while rented to you, or in the case of damage by fire, while rented to you or temporarily occupied by you with permission of the owner.

7. Subject to **5.** above, the Medical Expense Limit is the most we will pay under Coverage **C** for all medical expenses because of "bodily injury" sustained by any one person.

The Limits of Insurance of this Coverage Part apply separately to each consecutive annual period and to any remaining period of less than 12 months, starting with the beginning of the policy period shown in the Declarations, unless the policy period is extended after issuance for an additional period of less than 12 months. In that case, the additional period will be deemed part of the last preceding period for purposes of determining the Limits of Insurance.

SECTION IV – COMMERCIAL GENERAL LIABILITY CONDITIONS

1. Bankruptcy

Bankruptcy or insolvency of the insured or of the insured's estate will not relieve us of our obligations under this Coverage Part.

2. Duties In The Event Of Occurrence, Offense, Claim Or Suit

a. You must see to it that we are notified as soon as practicable of an "occurrence" or an offense which may result in a claim. To the extent possible, notice should include:

(1) How, when and where the "occurrence" or offense took place;

(2) The names and addresses of any injured persons and witnesses; and

(3) The nature and location of any injury or damage arising out of the "occurrence" or offense.

b. If a claim is made or "suit" is brought against any insured, you must:

(1) Immediately record the specifics of the claim or "suit" and the date received; and

(2) Notify us as soon as practicable.

You must see to it that we receive written notice of the claim or "suit" as soon as practicable.

c. You and any other involved insured must:

(1) Immediately send us copies of any demands, notices, summonses or legal papers received in connection with the claim or "suit";

(2) Authorize us to obtain records and other information;

(3) Cooperate with us in the investigation or settlement of the claim or defense against the "suit"; and

(4) Assist us, upon our request, in the enforcement of any right against any person or organization which may be liable to the insured because of injury or damage to which this insurance may also apply.

d. No insured will, except at that insured's own cost, voluntarily make a payment, assume any obligation, or incur any expense, other than for first aid, without our consent.

3. Legal Action Against Us

No person or organization has a right under this Coverage Part:

a. To join us as a party or otherwise bring us into a "suit" asking for damages from an insured; or

b. To sue us on this Coverage Part unless all of its terms have been fully complied with.

A person or organization may sue us to recover on an agreed settlement or on a final judgment against an insured; but we will not be liable for damages that are not payable under the terms of this Coverage Part or that are in excess of the applicable limit of insurance. An agreed settlement means a settlement and release of liability signed by us, the insured and the claimant or the claimant's legal representative.

4. Other Insurance

If other valid and collectible insurance is available to the insured for a loss we cover under Coverages **A** or **B** of this Coverage Part, our obligations are limited as follows:

a. Primary Insurance

This insurance is primary except when **b.** below applies. If this insurance is primary, our obligations are not affected unless any of the other insurance is also primary. Then, we will share with all that other insurance by the method described in **c.** below.

b. Excess Insurance

This insurance is excess over:

(1) Any of the other insurance, whether primary, excess, contingent or on any other basis:

(a) That is Fire, Extended Coverage, Builder's Risk, Installation Risk or similar coverage for "your work";

(b) That is Fire insurance for premises rented to you or temporarily occupied by you with permission of the owner;

(c) That is insurance purchased by you to cover your liability as a tenant for "property damage" to premises rented to you or temporarily occupied by you with permission of the owner; or

(d) If the loss arises out of the maintenance or use of aircraft, "autos" or watercraft to the extent not subject to Exclusion **g.** of Section **I** – Coverage **A** – Bodily Injury And Property Damage Liability.

(2) Any other primary insurance available to you covering liability for damages arising out of the premises or operations, or the products and completed operations, for which you have been added as an additional insured by attachment of an endorsement.

When this insurance is excess, we will have no duty under Coverages **A** or **B** to defend the insured against any "suit" if any other insurer has a duty to defend the insured against that "suit". If no other insurer defends, we will undertake to do so, but we will be entitled to the insured's rights against all those other insurers.

When this insurance is excess over other insurance, we will pay only our share of the amount of the loss, if any, that exceeds the sum of:

(1) The total amount that all such other insurance would pay for the loss in the absence of this insurance; and

(2) The total of all deductible and self-insured amounts under all that other insurance.

We will share the remaining loss, if any, with any other insurance that is not described in this Excess Insurance provision and was not bought specifically to apply in excess of the Limits of Insurance shown in the Declarations of this Coverage Part.

c. Method Of Sharing

If all of the other insurance permits contribution by equal shares, we will follow this method also. Under this approach each insurer contributes equal amounts until it has paid its applicable limit of insurance or none of the loss remains, whichever comes first.

If any of the other insurance does not permit contribution by equal shares, we will contribute by limits. Under this method, each insurer's share is based on the ratio of its applicable limit of insurance to the total applicable limits of insurance of all insurers.

5. Premium Audit

a. We will compute all premiums for this Coverage Part in accordance with our rules and rates.

b. Premium shown in this Coverage Part as advance premium is a deposit premium only. At the close of each audit period we will compute the earned premium for that period and send notice to the first Named Insured. The due date for audit and retrospective premiums is the date shown as the due date on the bill. If the sum of the advance and audit premiums paid for the policy period is greater than the earned premium, we will return the excess to the first Named Insured.

c. The first Named Insured must keep records of the information we need for premium computation, and send us copies at such times as we may request.

6. Representations

By accepting this policy, you agree:

a. The statements in the Declarations are accurate and complete;

b. Those statements are based upon representations you made to us; and

c. We have issued this policy in reliance upon your representations.

7. Separation Of Insureds

Except with respect to the Limits of Insurance, and any rights or duties specifically assigned in this Coverage Part to the first Named Insured, this insurance applies:

a. As if each Named Insured were the only Named Insured; and

b. Separately to each insured against whom claim is made or "suit" is brought.

8. Transfer Of Rights Of Recovery Against Others To Us

If the insured has rights to recover all or part of any payment we have made under this Coverage Part, those rights are transferred to us. The insured must do nothing after loss to impair them. At our request, the insured will bring "suit" or transfer those rights to us and help us enforce them.

9. When We Do Not Renew

If we decide not to renew this Coverage Part, we will mail or deliver to the first Named Insured shown in the Declarations written notice of the nonrenewal not less than 30 days before the expiration date.

If notice is mailed, proof of mailing will be sufficient proof of notice.

SECTION V – DEFINITIONS

1. "Advertisement" means a notice that is broadcast or published to the general public or specific market segments about your goods, products or services for the purpose of attracting customers or supporters. For the purposes of this definition:

a. Notices that are published include material placed on the Internet or on similar electronic means of communication; and

b. Regarding web-sites, only that part of a web-site that is about your goods, products or services for the purposes of attracting customers or supporters is considered an advertisement.

2. "Auto" means:

a. A land motor vehicle, trailer or semitrailer designed for travel on public roads, including any attached machinery or equipment; or

b. Any other land vehicle that is subject to a compulsory or financial responsibility law or other motor vehicle insurance law in the state where it is licensed or principally garaged.

However, "auto" does not include "mobile equipment".

3. "Bodily injury" means bodily injury, sickness or disease sustained by a person, including death resulting from any of these at any time.

4. "Coverage territory" means:

a. The United States of America (including its territories and possessions), Puerto Rico and Canada;

b. International waters or airspace, but only if the injury or damage occurs in the course of travel or transportation between any places included in **a.** above; or

c. All other parts of the world if the injury or damage arises out of:

(1) Goods or products made or sold by you in the territory described in **a.** above;

(2) The activities of a person whose home is in the territory described in **a.** above, but is away for a short time on your business; or

(3) "Personal and advertising injury" offenses that take place through the Internet or similar electronic means of communication

provided the insured's responsibility to pay damages is determined in a "suit" on the merits, in the territory described in **a.** above or in a settlement we agree to.

5. "Employee" includes a "leased worker". "Employee" does not include a "temporary worker".

6. "Executive officer" means a person holding any of the officer positions created by your charter, constitution, by-laws or any other similar governing document.

7. "Hostile fire" means one which becomes uncontrollable or breaks out from where it was intended to be.

8. "Impaired property" means tangible property, other than "your product" or "your work", that cannot be used or is less useful because:

a. It incorporates "your product" or "your work" that is known or thought to be defective, deficient, inadequate or dangerous; or

b. You have failed to fulfill the terms of a contract or agreement;

if such property can be restored to use by:

a. The repair, replacement, adjustment or removal of "your product" or "your work"; or

b. Your fulfilling the terms of the contract or agreement.

9. "Insured contract" means:

a. A contract for a lease of premises. However, that portion of the contract for a lease of premises that indemnifies any person or organization for damage by fire to premises while rented to you or temporarily occupied by you with permission of the owner is not an "insured contract";

b. A sidetrack agreement;

c. Any easement or license agreement, except in connection with construction or demolition operations on or within 50 feet of a railroad;

d. An obligation, as required by ordinance, to indemnify a municipality, except in connection with work for a municipality;

e. An elevator maintenance agreement;

f. That part of any other contract or agreement pertaining to your business (including an indemnification of a municipality in connection with work performed for a municipality) under which you assume the tort liability of another party to pay for "bodily injury" or "property damage" to a third person or organization. Tort liability means a liability that would be imposed by law in the absence of any contract or agreement.

Paragraph **f.** does not include that part of any contract or agreement:

(1) That indemnifies a railroad for "bodily injury" or "property damage" arising out of construction or demolition operations, within 50 feet of any railroad property and affecting any railroad bridge or trestle, tracks, roadbeds, tunnel, underpass or crossing;

(2) That indemnifies an architect, engineer or surveyor for injury or damage arising out of:

(a) Preparing, approving, or failing to prepare or approve, maps, shop drawings, opinions, reports, surveys, field orders, change orders or drawings and specifications; or

(b) Giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage; or

(3) Under which the insured, if an architect, engineer or surveyor, assumes liability for an injury or damage arising out of the insured's rendering or failure to render professional services, including those listed in **(2)** above and supervisory, inspection, architectural or engineering activities.

10. "Leased worker" means a person leased to you by a labor leasing firm under an agreement between you and the labor leasing firm, to perform duties related to the conduct of your business. "Leased worker" does not include a "temporary worker".

11. "Loading or unloading" means the handling of property:

a. After it is moved from the place where it is accepted for movement into or onto an aircraft, watercraft or "auto";

b. While it is in or on an aircraft, watercraft or "auto"; or

c. While it is being moved from an aircraft, watercraft or "auto" to the place where it is finally delivered;

but "loading or unloading" does not include the movement of property by means of a mechanical device, other than a hand truck, that is not attached to the aircraft, watercraft or "auto".

12. "Mobile equipment" means any of the following types of land vehicles, including any attached machinery or equipment:

a. Bulldozers, farm machinery, forklifts and other vehicles designed for use principally off public roads;

b. Vehicles maintained for use solely on or next to premises you own or rent;

c. Vehicles that travel on crawler treads;

d. Vehicles, whether self-propelled or not, maintained primarily to provide mobility to permanently mounted:

(1) Power cranes, shovels, loaders, diggers or drills; or

(2) Road construction or resurfacing equipment such as graders, scrapers or rollers;

e. Vehicles not described in **a., b., c.** or **d.** above that are not self-propelled and are maintained primarily to provide mobility to permanently attached equipment of the following types:

(1) Air compressors, pumps and generators, including spraying, welding, building cleaning, geophysical exploration, lighting and well servicing equipment; or

(2) Cherry pickers and similar devices used to raise or lower workers;

f. Vehicles not described in **a., b., c.** or **d.** above maintained primarily for purposes other than the transportation of persons or cargo.

However, self-propelled vehicles with the following types of permanently attached equipment are not "mobile equipment" but will be considered "autos":

(1) Equipment designed primarily for:

(a) Snow removal;

(b) Road maintenance, but not construction or resurfacing; or

(c) Street cleaning;

(2) Cherry pickers and similar devices mounted on automobile or truck chassis and used to raise or lower workers; and

(3) Air compressors, pumps and generators, including spraying, welding, building cleaning, geophysical exploration, lighting and well servicing equipment.

However, "mobile equipment" does not include any land vehicles that are subject to a compulsory or financial responsibility law or other motor vehicle insurance law in the state where it is licensed or principally garaged. Land vehicles subject to a compulsory or financial responsibility law or other motor vehicle insurance law are considered "autos".

13. "Occurrence" means an accident, including continuous or repeated exposure to substantially the same general harmful conditions.

14. "Personal and advertising injury" means injury, including consequential "bodily injury", arising out of one or more of the following offenses:

a. False arrest, detention or imprisonment;

b. Malicious prosecution;

c. The wrongful eviction from, wrongful entry into, or invasion of the right of private occupancy of a room, dwelling or premises that a person occupies, committed by or on behalf of its owner, landlord or lessor;

d. Oral or written publication, in any manner, of material that slanders or libels a person or organization or disparages a person's or organization's goods, products or services;

e. Oral or written publication, in any manner, of material that violates a person's right of privacy;

f. The use of another's advertising idea in your "advertisement"; or

g. Infringing upon another's copyright, trade dress or slogan in your "advertisement".

15. "Pollutants" mean any solid, liquid, gaseous or thermal irritant or contaminant, including smoke, vapor, soot, fumes, acids, alkalis, chemicals and waste. Waste includes materials to be recycled, reconditioned or reclaimed.

16. "Products-completed operations hazard":

a. Includes all "bodily injury" and "property damage" occurring away from premises you own or rent and arising out of "your product" or "your work" except:

(1) Products that are still in your physical possession; or

(2) Work that has not yet been completed or abandoned. However, "your work" will be deemed completed at the earliest of the following times:

(a) When all of the work called for in your contract has been completed.

(b) When all of the work to be done at the job site has been completed if your contract calls for work at more than one job site.

(c) When that part of the work done at a job site has been put to its intended use by any person or organization other than another contractor or subcontractor working on the same project.

Work that may need service, maintenance, correction, repair or replacement, but which is otherwise complete, will be treated as completed.

b. Does not include "bodily injury" or "property damage" arising out of:

(1) The transportation of property, unless the injury or damage arises out of a condition in or on a vehicle not owned or operated by you, and that condition was created by the "loading or unloading" of that vehicle by any insured;

(2) The existence of tools, uninstalled equipment or abandoned or unused materials; or

(3) Products or operations for which the classification, listed in the Declarations or in a policy schedule, states that products-completed operations are subject to the General Aggregate Limit.

17. "Property damage" means:

a. Physical injury to tangible property, including all resulting loss of use of that property. All such loss of use shall be deemed to occur at the time of the physical injury that caused it; or

b. Loss of use of tangible property that is not physically injured. All such loss of use shall be deemed to occur at the time of the "occurrence" that caused it.

For the purposes of this insurance, electronic data is not tangible property.

As used in this definition, electronic data means information, facts or programs stored as or on, created or used on, or transmitted to or from computer software, including systems and applications software, hard or floppy disks, CD-ROMS, tapes, drives, cells, data processing devices or any other media which are used with electronically controlled equipment.

18. "Suit" means a civil proceeding in which damages because of "bodily injury", "property damage" or "personal and advertising injury" to which this insurance applies are alleged. "Suit" includes:

a. An arbitration proceeding in which such damages are claimed and to which the insured must submit or does submit with our consent; or

b. Any other alternative dispute resolution proceeding in which such damages are claimed and to which the insured submits with our consent.

19. "Temporary worker" means a person who is furnished to you to substitute for a permanent "employee" on leave or to meet seasonal or short-term workload conditions.

20. "Volunteer worker" means a person who is not your "employee", and who donates his or her work and acts at the direction of and within the scope of duties determined by you, and is not paid a fee, salary or other compensation by you or anyone else for their work performed for you.

21. "Your product":

a. Means:

(1) Any goods or products, other than real property, manufactured, sold, handled, distributed or disposed of by:

(a) You;

(b) Others trading under your name; or

(c) A person or organization whose business or assets you have acquired; and

(2) Containers (other than vehicles), materials, parts or equipment furnished in connection with such goods or products.

b. Includes

(1) Warranties or representations made at any time with respect to the fitness, quality, durability, performance or use of "your product"; and

(2) The providing of or failure to provide warnings or instructions.

c. Does not include vending machines or other property rented to or located for the use of others but not sold.

22. "Your work":

a. Means:

(1) Work or operations performed by you or on your behalf; and

(2) Materials, parts or equipment furnished in connection with such work or operations.

b. Includes

(1) Warranties or representations made at any time with respect to the fitness, quality, durability, performance or use of "your work", and

(2) The providing of or failure to provide warnings or instructions.

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POLICY NUMBER:

COMMERCIAL GENERAL LIABILITY
CG 20 10 07 04

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

ADDITIONAL INSURED – OWNERS, LESSEES OR CONTRACTORS – SCHEDULED PERSON OR ORGANIZATION

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

SCHEDULE

Name Of Additional Insured Person(s) Or Organization(s):	Location(s) Of Covered Operations
Information required to complete this Schedule, if not shown above, will be shown in the Declarations.	

A. **Section II – Who Is An Insured** is amended to include as an additional insured the person(s) or organization(s) shown in the Schedule, but only with respect to liability for "bodily injury", "property damage" or "personal and advertising injury" caused, in whole or in part, by:

1. Your acts or omissions; or
2. The acts or omissions of those acting on your behalf;

in the performance of your ongoing operations for the additional insured(s) at the location(s) designated above.

B. With respect to the insurance afforded to these additional insureds, the following additional exclusions apply:

This insurance does not apply to "bodily injury" or "property damage" occurring after:

1. All work, including materials, parts or equipment furnished in connection with such work, on the project (other than service, maintenance or repairs) to be performed by or on behalf of the additional insured(s) at the location of the covered operations has been completed; or
2. That portion of "your work" out of which the injury or damage arises has been put to its intended use by any person or organization other than another contractor or subcontractor engaged in performing operations for a principal as a part of the same project.

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POLICY NUMBER:

COMMERCIAL GENERAL LIABILITY
CG 20 37 07 04

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

ADDITIONAL INSURED – OWNERS, LESSEES OR CONTRACTORS – COMPLETED OPERATIONS

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

SCHEDULE

Name Of Additional Insured Person(s) Or Organization(s):	Location And Description Of Completed Operations
Information required to complete this Schedule, if not shown above, will be shown in the Declarations.	

Section II – Who Is An Insured is amended to include as an additional insured the person(s) or organization(s) shown in the Schedule, but only with respect to liability for "bodily injury" or "property damage" caused, in whole or in part, by "your work" at the location designated and described in the schedule of this endorsement performed for that additional insured and included in the "products-completed operations hazard".

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POLICY NUMBER:

COMMERCIAL GENERAL LIABILITY
CG 25 04 03 97

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

DESIGNATED LOCATION(S) GENERAL AGGREGATE LIMIT

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

SCHEDULE

Designated Location(s):

(If no entry appears above, information required to complete this endorsement will be shown in the Declarations as applicable to this endorsement.)

A. For all sums which the insured becomes legally obligated to pay as damages caused by "occurrences" under COVERAGE **A** (SECTION **I**), and for all medical expenses caused by accidents under COVERAGE **C** (SECTION **I**), which can be attributed only to operations at a single designated "location" shown in the Schedule above:

1. A separate Designated Location General Aggregate Limit applies to each designated "location", and that limit is equal to the amount of the General Aggregate Limit shown in the Declarations.

2. The Designated Location General Aggregate Limit is the most we will pay for the sum of all damages under COVERAGE **A,** except damages because of "bodily injury" or "property damage" included in the "products-completed operations hazard", and for medical expenses under COVERAGE **C** regardless of the number of:

a. Insureds;

b. Claims made or "suits" brought; or

c. Persons or organizations making claims or bringing "suits".

3. Any payments made under COVERAGE **A** for damages or under COVERAGE **C** for medical expenses shall reduce the Designated Location General Aggregate Limit for that designated "location". Such payments shall not reduce the General Aggregate Limit shown in the Declarations nor shall they reduce any other Designated Location General Aggregate Limit for any other designated "location" shown in the Schedule above.

4. The limits shown in the Declarations for Each Occurrence, Fire Damage and Medical Expense continue to apply. However, instead of being subject to the General Aggregate Limit shown in the Declarations, such limits will be subject to the applicable Designated Location General Aggregate Limit.

   ☐

B. For all sums which the insured becomes legally obligated to pay as damages caused by "occurrences" under COVERAGE **A** (SECTION **I**), and for all medical expenses caused by accidents under COVERAGE **C** (SECTION **I**), which cannot be attributed only to operations at a single designated "location" shown in the Schedule above:

1. Any payments made under COVERAGE **A** for damages or under COVERAGE **C** for medical expenses shall reduce the amount available under the General Aggregate Limit or the Products-Completed Operations Aggregate Limit, whichever is applicable; and

2. Such payments shall not reduce any Designated Location General Aggregate Limit.

C. When coverage for liability arising out of the "products-completed operations hazard" is provided, any payments for damages because of "bodily injury" or "property damage" included in the "products-completed operations hazard" will reduce the Products-Completed Operations Aggregate Limit, and not reduce the General Aggregate Limit nor the Designated Location General Aggregate Limit.

D. For the purposes of this endorsement, the **Definitions** Section is amended by the addition of the following definition:

"Location" means premises involving the same or connecting lots, or premises whose connection is interrupted only by a street, roadway, waterway or right-of-way of a railroad.

E. The provisions of Limits Of Insurance (SECTION **III**) not otherwise modified by this endorsement shall continue to apply as stipulated.

AIA® Document G703™ – 1992

Continuation Sheet University of Maine System Project

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

APPLICATION NO: 001
APPLICATION DATE:
PERIOD TO:
ARCHITECT'S PROJECT NO:

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

User Notes: (929777463)

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AIA® Document G702™ – 1992

Application and Certificate for Payment

TO OWNER: University of Maine System
16 Central Street, Bangor, ME
04401-5106

PROJECT: University of Maine System Project

APPLICATION NO: 001
PERIOD TO:
CONTRACT FOR:
CONTRACT DATE:
PROJECT NOS: / /

Distribution to:
OWNER:
ARCHITECT:
CONTRACTOR:
FIELD:
OTHER:

FROM CONTRACTOR:

VIA ARCHITECT:

CONTRACTOR'S APPLICATION FOR PAYMENT

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

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

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

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

CONTRACTOR:

By: _____ Date: _____

State of:

County of:

Subscribed and sworn to before me this day of

Notary Public:
My Commission expires:

ARCHITECT'S CERTIFICATE FOR PAYMENT

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

AMOUNT CERTIFIED ..... $ 0.00

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

ARCHITECT:

By: _____ Date: _____

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

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Sales Tax Form

Date _____

TO: _____
Vendor Name

_____
Vendor Address

_____
Vendor City State Zip

I hereby certify under penalties of perjury, that:

I am engaged in the performance of a construction contract on a project for the University of Maine System which is a Sales Tax exempt organization under the Maine Sales and Use Tax Law, Section 1760, subsection 2 and 16;

This Project is titled: USM Central Heat Plant Upgrades
Project Title

This project is located at: University of Southern Maine, Portland, ME
Campus Name or Town

This certificate is issued to cover purchases of materials that will be permanently incorporated into the real property belonging to the exempt organization or government agency indicated above.

Signed: _____
Authorized Signature

FIRM _____

_____

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AIA® Document G707A™ – 1994

Consent of Surety to Reduction in or Partial Release of Retainage

PROJECT: *(Name and address)* University of Maine System Project	**ARCHITECT'S PROJECT NUMBER:**	OWNER: ☐ ARCHITECT: ☐
	CONTRACT FOR:	CONTRACTOR: ☐
TO OWNER: *(Name and address)* University of Maine System 16 Central Street Bangor, ME 04401-5106	**CONTRACT DATED:**	SURETY: ☐ OTHER: ☐

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the
(Insert name and address of Surety)

, SURETY,

on bond of
(Insert name and address of Contractor)

, CONTRACTOR,

hereby approves the reduction in or partial release of retainage to the Contractor as follows:

The Surety agrees that such reduction in or partial release of retainage to the Contractor shall not relieve the Surety of any of its obligations to
(Insert name and address of Owner)

, OWNER,

as set forth in said Surety's bond.

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:
(Insert in writing the month followed by the numeric date and year.)

_____
(Surety)

_____
(Signature of authorized representative)

Attest:
(Seal):

_____
(Printed name and title)

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STORED MATERIALS

University of Maine ; University of Southern Maine
P.O. Box 9300, Portland, ME 04104-9300

Project Title: USM Central Heat Plant Upgrades
Location: Portland, ME
Contractor: _____

Materials and/or equipment (hereinafter "Materials") that have not yet been incorporated into the work may be delivered and suitably stored, at the site or some other location agreed upon by the Owner. The Materials listed below have been estimated at 100% of the cost and will be stored at _____. The Owner will reimburse the Contractor based upon the prices included on the Schedule of Values Form, 00 62 73(AIA G703), less the cost of installation. The Contractor must complete sufficient copies of this Stored Materials Form, 00 62 79, to accompany the Application for Payment. The Contractor shall secure the signature of its bonding company on all forms and shall also provide a Power of Attorney from the bonding company.

SCHEDULE

Qty	Material/Equipment	Item in AIA G703		Unit Wholesale Price	Extended Wholesale Price
		Item No	Unit Price		
				Total	

Surety _____ By: _____
Attorney-in-Fact

Power of Attorney Must be Attached

Date: _____

BILL OF SALE

The Contractor, _____, (will store/has stored) certain Materials (at the site of this project/at an approved warehouse/at bonded warehouse) and will be paid in accordance with the provisions of the General Conditions of the Contract for Construction. In consideration of the sum of $_____ paid to the contractor by the Owner, and, incompliance with the provisions of the Contract, and, with the intention to be legally bound, the Contractor does hereby grant, bargain, sell and deliver unto the Owner, it successors and assigns, all and singular, the Materials described in the schedule above. The Contractor agrees that:

1. Contractor has good title to the Materials, free and clear of all liens and encumbrances, and title is granted to the Owner;

2. The Materials will be used only in the construction of the above referenced project, under the provisions of the Contract, and will not be diverted elsewhere without the prior written consent of the Owner;

3. The Materials have been delivered to and are at the places approved for storage, and they are clearly marked and identified as the property of the Owner and are stored in a safe and secure manner to protect from damage or loss;

4. The Contractor will pay all expenses in connection with the sale, delivery, storage, protection and insurance of Materials granted to the Owner.

5. The Contractor will remain responsible for the Materials, which will remain under its custody and control for all losses, and will fully indemnify the Owner for the cost of the Materials should the Materials be lost or damaged or stolen, regardless of exclusions in insurance policies required under this document. The contractor has insured the Materials against loss or damage by fire (with extended coverage), theft and burglary, with loss payable to the Owner;

6. The Contractor agrees that the quantities of Materials set forth in the Schedule of Values Form represents the maximum quantities for which it may be entitled to payment under the provisions of the contract;

7. The following information is included with this form:

   (1) An Application for Payment;
   (2) An invoice or copy of an invoice for Materials stored;
   (3) Evidence of payment, or when payment has not been made, a letter on the Contractor's letterhead authorizing payment to be made jointly to the Contractor and the Supplier;
   (4) Photographs showing the stored Materials and its location;
   (5) a fire and theft insurance policy rider for the stored Materials.
   (6) a warehouseman's receipt acknowledging that the Materials being stored at the warehouse are being held for the benefit of the Contractor or/or University.

Witness:

_____ By: _____ (SEAL)
Principal/Contractor-Individual

Witness:

_____
Principal/Contractor-Individual

_____ _____ (SEAL)

_____ _____ (SEAL)

_____ _____ (SEAL)

_____ _____ (SEAL)

Attest:

_____
Principal/Contractor-Corporation

_____ By: _____
Secretary President

AIA® Document G716™ – 2004

Request for Information ("RFI")

TO: **FROM:**

PROJECT: **ISSUE DATE:** **RFI No.** 001
University of Maine System Project

REQUESTED REPLY DATE:
PROJECT NUMBERS: / **COPIES TO:**

RFI DESCRIPTION: *(Fully describe the question or type of information requested.)*

REFERENCES/ATTACHMENTS: *(List specific documents researched when seeking the information requested.)*
SPECIFICATIONS: **DRAWINGS:** **OTHER:**

SENDER'S RECOMMENDATION: *(If RFI concerns a site or construction condition, the sender may provide a recommended solution, including cost and/or schedule considerations.)*

RECEIVER'S REPLY: *(Provide answer to RFI, including cost and/or schedule considerations.)*

BY **DATE** **COPIES TO**

Note: This reply is not an authorization to proceed with work involving additional cost, time or both. If any reply requires a change to the Contract Documents, a Change Order, Construction Change Directive or a Minor Change in the work must be executed in accordance with the Contract Documents.

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AIA® Document G710™ – 1992

Architect's Supplemental Instructions

PROJECT *(Name and address)*:
University of Maine System Project

ARCHITECT'S SUPPLEMENTAL INSTRUCTION NO:

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

OWNER *(Name and address)*:
University of Maine System
16 Central Street
Bangor, ME 04401-5106

DATE OF ISSUANCE:

CONTRACT FOR:

FROM ARCHITECT *(Name and address)*:

CONTRACT DATE:

TO CONTRACTOR *(Name and address)*:

ARCHITECT'S PROJECT NUMBER:

The Work shall be carried out in accordance with the following supplemental instructions issued in accordance with the Contract Documents without change in Contract Sum or Contract Time. Proceeding with the Work in accordance with these instructions indicates your acknowledgment that there will be no change in the Contract Sum or Contract Time.

DESCRIPTION:

ATTACHMENTS:
(Here insert listing of documents that support description.)

ISSUED BY THE ARCHITECT:

_____ _____
(Signature) *(Printed name and title)*

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AIA® Document G714™ – 2007

Construction Change Directive

PROJECT: *(Name and address)* University of Maine System Project **TO CONTRACTOR:** *(Name and address)*	**DIRECTIVE NUMBER:** **DATE:** **CONTRACT FOR:** **CONTRACT DATED:** **ARCHITECT'S PROJECT NUMBER:**	OWNER: ☐ ARCHITECT: ☐ CONSULTANT: ☐ CONTRACTOR: ☐ FIELD: ☐ OTHER: ☐

You are hereby directed to make the following change(s) in this Contract:
(Describe briefly any proposed changes or list any attached information in the alternative)

PROPOSED ADJUSTMENTS

1. The proposed basis of adjustment to the Contract Sum or Guaranteed Maximum Price is:
   - ☒ • Lump Sum decrease of $0.00
   - ☐ • Unit Price of $ per
   - ☐ • As provided in Section 7.3.3 of AIA Document A201-2007
   - ☐ • As follows:

2. The Contract Time is proposed to ( ). The proposed adjustment, if any, is days.

When signed by the Owner and Architect and received by the Contractor, this document becomes effective IMMEDIATELY as a Construction Change Directive (CCD), and the Contractor shall proceed with the change(s) described above.

Contractor signature indicates agreement with the proposed adjustments in Contract Sum and Contract Time set forth in this CCD.

ARCHITECT *(Firm name)*	**OWNER** *(Firm name)*	**CONTRACTOR** *(Firm name)*
ADDRESS	**ADDRESS**	**ADDRESS**
BY *(Signature)*	**BY** *(Signature)*	**BY** *(Signature)*
(Typed name)	*(Typed name)*	*(Typed name)*
DATE	**DATE**	**DATE**

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AIA® Document G709™ – 2001

Work Changes Proposal Request

PROJECT *(Name and address):*
University of Maine System Project

OWNER *(Name and address)*:

FROM ARCHITECT *(Name and address)*:

TO CONTRACTOR *(Name and address)*:

PROPOSAL REQUEST NUMBER:

DATE OF ISSUANCE:

CONTRACT FOR:

CONTRACT DATE:

ARCHITECT'S PROJECT NUMBER:

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

Please submit an itemized proposal for changes in the Contract Sum and Contract Time for proposed modifications to the Contract Documents described herein. Within ( ) days, the Contractor must submit this proposal or notify the Architect, in writing, of the date on which proposal submission is anticipated.

THIS IS NOT A CHANGE ORDER, A CONSTRUCTION CHANGE DIRECTIVE OR A DIRECTION TO PROCEED WITH THE WORK DESCRIBED IN THE PROPOSED MODIFICATIONS.

DESCRIPTION *(Insert a written description of the Work)*:

ATTACHMENTS *(List attached documents that support description)*:

REQUESTED BY THE ARCHITECT:

(Signature) _____ *(Printed name and title)* _____

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AIA® Document G701™ – 2001

Change Order

PROJECT *(Name and address):* University of Maine System Project	**CHANGE ORDER NUMBER:**	OWNER: ☐
	DATE:	ARCHITECT: ☐
TO CONTRACTOR *(Name and address):*	**ARCHITECT'S PROJECT NUMBER:**	CONTRACTOR: ☐
	CONTRACT DATE:	FIELD: ☐
	CONTRACT FOR:	OTHER: ☐

THE CONTRACT IS CHANGED AS FOLLOWS:
(Include, where applicable, any undisputed amount attributable to previously executed Construction Change Directives)

The original Contract Sum was	$	0.00
The net change by previously authorized Change Orders	$	0.00
The Contract Sum prior to this Change Order was	$	0.00
The Contract Sum will be increased by this Change Order in the amount of	$	0.00
The new Contract Sum including this Change Order will be	$	0.00

The Contract Time will be increased by Zero (0) days.
The date of Substantial Completion as of the date of this Change Order therefore is

NOTE: This Change Order does not include changes in the Contract Sum, Contract Time or Guaranteed Maximum Price which have been authorized by Construction Change Directive until the cost and time have been agreed upon by both the Owner and Contractor, in which case a Change Order is executed to supersede the Construction Change Directive.

NOT VALID UNTIL SIGNED BY THE ARCHITECT, CONTRACTOR AND OWNER.

ARCHITECT *(Firm name)*	**CONTRACTOR** *(Firm name)*	**OWNER** *(Firm name)*
ADDRESS	**ADDRESS**	**ADDRESS**
BY *(Signature)*	**BY** *(Signature)*	**BY** *(Signature)*
(Typed name)	*(Typed name)*	*(Typed name)*
DATE	**DATE**	**DATE**

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AIA® Document G704™ – 2000

Certificate of Substantial Completion

PROJECT:
(Name and address):
University of Maine System Project

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

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

TO OWNER:
(Name and address):
University of Maine System
16 Central Street
Bangor, ME 04401-5106

TO CONTRACTOR:
(Name and address):

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

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

Warranty **Date of Commencement**

ARCHITECT	BY	DATE OF ISSUANCE

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

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

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

CONTRACTOR	BY	DATE

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

OWNER	BY	DATE

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

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University of Maine System
Certificate of Completion
(Final)

CONTRACT DATED:

PROJECT NAME: USM Central Heat Plant Upgrades

SUSTANTIAL COMPLETION DATE: Septemver 1, 2015

FINAL COMPLETION is defined, in accordance with Article 9 of the General Conditions, as the date certified by the Architect when all the Work of the Project is fully complete, the Close-Out requirements of Paragraph 9.10 of the General Conditions have been completed, including the Close-Out Meeting and approval of Close-Out by the Architect, in accordance with Subparagraph 9.10.2, and the Contract fully performed in accordance with the Contract Documents, and the Contractor entitled to final payment.

The CONTRACTOR certifies that the Work is fully completed and was completed on or before _____, 20__, and submits herewith:

Application for Final Payment (AIA G702, or equal)
Affidavit of Payments (AIA G706, or equal)
Consent of Surety (AIA G707, or equal)
Release of Liens (AIA G706A, or equal)
Waiver of Lien

CONTRACTOR:

By: _____ Date: _____

The Architect has inspected the Work and has determined that the Date of Final Completion was _____, 20__.

ARCHITECT:

By: _____ Date: _____

The OWNER hereby accepts the Work as fully complete and will make final payment.

By: _____
Robert W. Bertram
Executive Director of Facilities Management
University of Maine , University of Southern Maine
Date: _____

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AIA® Document G706™ – 1994

Contractor's Affidavit of Payment of Debts and Claims

PROJECT: *(Name and address)* University of Maine System Project	**ARCHITECT'S PROJECT NUMBER:**	OWNER: ☐ ARCHITECT: ☐ CONTRACTOR: ☐
	CONTRACT FOR: General Construction	SURETY: ☐
TO OWNER: *(Name and address)*	**CONTRACT DATED:**	OTHER: ☐

STATE OF:
COUNTY OF:

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

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

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

Indicate Attachment ☐ Yes ☒ No

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

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.

2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

3. Contractor's Affidavit of Release of Liens (AIA Document G706A).

CONTRACTOR: *(Name and address)*

BY: _____
(Signature of authorized representative)

_____
(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:
My Commission Expires:

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AIA® Document G706A™ – 1994

Contractor's Affidavit of Release of Liens

PROJECT: *(Name and address)*
University of Maine System Project2

ARCHITECT'S PROJECT NUMBER:

CONTRACT FOR: General Construction

CONTRACT DATED:

OWNER: ☐
ARCHITECT: ☐
CONTRACTOR: ☐
SURETY: ☐
OTHER: ☐

TO OWNER: *(Name and address)*
University of Maine System
16 Central Street
Bangor, ME 04401-5106

STATE OF: Maine
COUNTY OF:

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

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.

2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

CONTRACTOR: *(Name and address)*

BY:

(Signature of authorized representative)

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:
My Commission Expires:

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WAIVER OF LIEN

Date:
State of Maine
County of

TO: Office of Facilities
University of Maine System
16 Central Street
Bangor, ME 04401

SUBJECT University of Southern Maine
Project Name USM Central Heat Pllant Upgrades
Project Location Portland, Maine

Upon receipt of the sum of _____ (being the balance due us under the existing contract or subcontract agreement for work on the Subject Project) the undersigned agrees that it will waive and release the University of Maine System from any and all lien or claim or right to lien on the Subject Project under the Statutes of the State of Maine relating to liens for labor, materials and/or subcontracts furnished for the Subject Project on premises belonging to the University of Maine System.

Signed: _____
Authorized Signature

Title _____

Firm Name: _____

NOTARY

Subscribed and sworn to before me this _____ day of _____, 20_____.

_____
Signature Notary Public

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AIA® Document G707™ – 1994

Consent Of Surety to Final Payment

PROJECT: *(Name and address)* University of Maine System Project	**ARCHITECT'S PROJECT NUMBER:**	OWNER: ☐
	CONTRACT FOR:	ARCHITECT: ☐
TO OWNER: *(Name and address)* University of Maine System 16 Central Street Bangor, ME 04401-5106	**CONTRACT DATED:**	CONTRACTOR: ☐ SURETY: ☐ OTHER: ☐

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the
(Insert name and address of Surety)

, SURETY,

on bond of
(Insert name and address of Contractor)

, CONTRACTOR,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve the Surety of any of its obligations to
(Insert name and address of Owner)

, OWNER,

as set forth in said Surety's bond.

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:
(Insert in writing the month followed by the numeric date and year.)

_____
(Surety)

_____
(Signature of authorized representative)

Attest:
(Seal):

_____
(Printed name and title)

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AIA® Document A201™ – 2007

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)
University of Maine System Project

THE OWNER:
(Name, legal status and address)
University of Maine System
16 Central Street
Bangor, ME 04401-5106

THE ARCHITECT:
(Name, legal status and address)

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

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

TABLE OF ARTICLES

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/

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(Numbers and Topics in Bold are Section Headings)

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 BASIC DEFINITIONS

§ 1.1.1 THE CONTRACT DOCUMENTS

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

§ 1.1.2 THE CONTRACT

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

§ 1.1.3 THE WORK

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

§ 1.1.4 THE PROJECT

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

§ 1.1.5 THE DRAWINGS

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

§ 1.1.6 THE SPECIFICATIONS

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

§ 1.1.7 INSTRUMENTS OF SERVICE

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

§ 1.1.8 INITIAL DECISION MAKER

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

§ 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

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

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

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

§ 1.3 CAPITALIZATION

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

§ 1.4 INTERPRETATION

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

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

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

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

§ 1.6 TRANSMISSION OF DATA IN DIGITAL FORM

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

ARTICLE 2 OWNER

§ 2.1 GENERAL

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

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

§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

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

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

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

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

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

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

§ 2.3 OWNER'S RIGHT TO STOP THE WORK

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

§ 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

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

ARTICLE 3 CONTRACTOR

§ 3.1 GENERAL

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

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

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

§ 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

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

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

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

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

§ 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

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

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

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

§ 3.4 LABOR AND MATERIALS

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

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

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

§ 3.5 WARRANTY

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

§ 3.6 TAXES

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

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

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

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

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

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

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 ALLOWANCES

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

§ 3.8.2 Unless otherwise provided in the Contract Documents,

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

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

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

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

§ 3.9 SUPERINTENDENT

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

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

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

§ 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

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

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

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

§ 3.11 DOCUMENTS AND SAMPLES AT THE SITE

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

§ 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

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

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

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

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

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

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

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

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

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

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and

completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

§ 3.13 USE OF SITE

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

§ 3.14 CUTTING AND PATCHING

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

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

§ 3.15 CLEANING UP

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

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

§ 3.16 ACCESS TO WORK

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

§ 3.17 ROYALTIES, PATENTS AND COPYRIGHTS

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

§ 3.18 INDEMNIFICATION

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

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

ARTICLE 4 ARCHITECT

§ 4.1 GENERAL

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

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

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

§ 4.2 ADMINISTRATION OF THE CONTRACT

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

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

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

§ 4.2.4 COMMUNICATIONS FACILITATING CONTRACT ADMINISTRATION

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

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

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

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

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

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

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

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

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

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

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

ARTICLE 5 SUBCONTRACTORS

§ 5.1 DEFINITIONS

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

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

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

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

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

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

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

§ 5.3 SUBCONTRACTUAL RELATIONS

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

§ 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

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

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

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

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

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

§ 5.4.3 Upon such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the

Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

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

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

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

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

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

§ 6.2 MUTUAL RESPONSIBILITY

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

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

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

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

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

§ 6.3 OWNER'S RIGHT TO CLEAN UP

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

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 GENERAL

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

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

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

§ 7.2 CHANGE ORDERS

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

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

§ 7.3 CONSTRUCTION CHANGE DIRECTIVES

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

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

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

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
.2 Unit prices stated in the Contract Documents or subsequently agreed upon;
.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
.4 As provided in Section 7.3.7.

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

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

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

§ 7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount

for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

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

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

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

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

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

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

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

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

§ 7.4 MINOR CHANGES IN THE WORK

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

ARTICLE 8 TIME

§ 8.1 DEFINITIONS

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

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

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

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

§ 8.2 PROGRESS AND COMPLETION

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

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

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

§ 8.3 DELAYS AND EXTENSIONS OF TIME

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

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

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

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 CONTRACT SUM

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

§ 9.2 SCHEDULE OF VALUES

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

§ 9.3 APPLICATIONS FOR PAYMENT

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

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

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

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

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or

encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

§ 9.4 CERTIFICATES FOR PAYMENT

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

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

§ 9.5 DECISIONS TO WITHHOLD CERTIFICATION

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

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
- **.3** failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
- **.4** reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- **.5** damage to the Owner or a separate contractor;
- **.6** reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- **.7** repeated failure to carry out the Work in accordance with the Contract Documents.

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

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

§ 9.6 PROGRESS PAYMENTS

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

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

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

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

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

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

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

§ 9.7 FAILURE OF PAYMENT

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' written notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 SUBSTANTIAL COMPLETION

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

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

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

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

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

§ 9.9 PARTIAL OCCUPANCY OR USE

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

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

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

§ 9.10 FINAL COMPLETION AND FINAL PAYMENT

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

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

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

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

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

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

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 SAFETY PRECAUTIONS AND PROGRAMS

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

§ 10.2 SAFETY OF PERSONS AND PROPERTY

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ARTICLE 11 INSURANCE AND BONDS
§ 11.1 CONTRACTOR'S LIABILITY INSURANCE
§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

.1 Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;
.2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
.3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
.4 Claims for damages insured by usual personal injury liability coverage;
.5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
.6 Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;
.7 Claims for bodily injury or property damage arising out of completed operations; and
.8 Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

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

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

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

§ 11.2 OWNER'S LIABILITY INSURANCE
The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

§ 11.3 PROPERTY INSURANCE

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

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

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

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

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

§ 11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

§ 11.3.2 BOILER AND MACHINERY INSURANCE

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

§ 11.3.3 LOSS OF USE INSURANCE

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

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

§ 11.3.5 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment

property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

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

§ 11.3.7 WAIVERS OF SUBROGATION

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

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

§ 11.3.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

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

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

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

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

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 UNCOVERING OF WORK

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

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

§ 12.2 CORRECTION OF WORK

§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

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

§ 12.2.2 AFTER SUBSTANTIAL COMPLETION

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

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

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

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

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

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

§ 12.3 ACCEPTANCE OF NONCONFORMING WORK

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

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 GOVERNING LAW

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

§ 13.2 SUCCESSORS AND ASSIGNS

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

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

§ 13.3 WRITTEN NOTICE

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

§ 13.4 RIGHTS AND REMEDIES

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

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

§ 13.5 TESTS AND INSPECTIONS

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

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

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by

such failure including those of repeated procedures and compensation for the Architect's services and expenses shall be at the Contractor's expense.

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

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

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

§ 13.6 INTEREST

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

§ 13.7 TIME LIMITS ON CLAIMS

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

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 TERMINATION BY THE CONTRACTOR

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

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

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

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

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

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

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

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

§ 14.2 TERMINATION BY THE OWNER FOR CAUSE

§ 14.2.1 The Owner may terminate the Contract if the Contractor

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

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

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

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

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

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

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

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

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

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

§ 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

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

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

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

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

§ 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

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

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

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

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

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

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

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 CLAIMS

§ 15.1.1 DEFINITION

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

§ 15.1.2 NOTICE OF CLAIMS

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

§ 15.1.3 CONTINUING CONTRACT PERFORMANCE

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

§ 15.1.4 CLAIMS FOR ADDITIONAL COST

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

§ 15.1.5 CLAIMS FOR ADDITIONAL TIME

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

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

§ 15.1.6 CLAIMS FOR CONSEQUENTIAL DAMAGES

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

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

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

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

§ 15.2 INITIAL DECISION

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

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

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

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

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

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

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

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

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

§ 15.3 MEDIATION

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

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

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

§ 15.4 ARBITRATION

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

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

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

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

§ 15.4.4 CONSOLIDATION OR JOINDER

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

§ 15.4.4.2 Either party, at its sole discretion, may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

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

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University of Maine System
Supplementary Conditions
to
AIA A201 2007 General Conditions of the Contract for Construction

§ 1.1.8 Add the following:

The Architect is the Initial Decision Maker for this Agreement.

§1.2.2 Add the following:

Where the Procurement Requirements include provisions that portions of the Work be File Bid in accordance with the requirements of the Maine Bid Depository System, the subcontracts for these portions of the work will cover the same scope of work as defined by the Procurement Requirements and the File Bid and shall have the same contract amount as listed in the successful bid.

§ 1.5.1 Add the following:

The provisions of this section shall not be deemed to modify the contract between the University of Maine System (the Owner) and the Architect under B102 2007 and B201 2007 and the University of Maine Supplementary Requirements to those documents regarding the Instruments of Service.

§ 1.5.2 Add the following:

The provisions of this section shall not be deemed to modify the contract between the University of Maine System (the Owner) and the Architect under B102 2007 and B201 2007 and the University of Maine Supplementary Requirements to those documents regarding the Instruments of Service.

§ 2.1.1.1 Insert the following:

§ 2.1.1.1 For the purpose of this Contract, the Owner is defined as: University of Maine System; 16 Central Street; Bangor, Maine 04401 acting through its duly authorized agent.

§2.2.1 Delete in its entirety

§3.4.2.1 Insert the following:

§ 3.4.2.1 After the Contract has been executed, the Owner and Architect may consider a formal request for substitution of products in place of those specified. The Owner shall deduct from the next payment made from the Contract Sum amounts paid to' the Architect to evaluate the Contractor's proposed substitutions and to make agreed-upon changes in the Drawings and Specifications made necessary by the Owner's acceptance of the substitutions.

By making requests for substitutions, the Contractor:

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

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

.3 Certifies that the cost data presented is complete and includes all related costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and

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

§3.4.4 Insert the following:

§ 3.4.4 If a wage scale prepared by the State of Maine Department of Labor, Bureau of Labor Standards, is included in the Contract Documents, such wage scale represents the minimum wages that must be paid in each category of labor employed on the project.

The provisions of Title 26 MRSA Chapter 15 Preference to Maine Workers and Contractors, apply to this project, including but not limited to:

§ **1310. Wage and benefits rates to be kept posted**

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.

§ 1311. Wage and benefit record of contractor

The contractor and each subcontractor in charge of the construction of a public work shall keep an accurate record showing the names and occupation of all laborers, workers and mechanics employed by them and all independent contractors working under contract with them in connection with the construction on the public works. The record must also show for all laborers, workers, mechanics and independent contractors the hours worked, the title of the job, the hourly rate or other method of remuneration and the actual wages or other compensation paid to each of the laborers, workers, mechanics and independent contractors. A copy of such a record must be kept at the job site and must be open at all reasonable hours to the inspection of the Bureau of Labor Standards and the public authority that let the contract and its officers and agents. It is not necessary to preserve those records for a period longer than 3 years after the termination of the contract. A copy of each such record must also be filed monthly with the public authority that let the contract. The filed record is a public record pursuant to Title 1, chapter 13, except that the public authority letting a contract shall adopt rules to protect the privacy of personal information

contained in the records filed with the public authority under this section, such as Social Security numbers and taxpayer identification numbers. The rules may not prevent the disclosure of information regarding the classification of workers or independent contractors and the remuneration they receive. Such rules are routine technical rules as defined by Title 5, chapter 375, subchapter 2-A.

§ 3.4.5 Insert the following:

§ 3.4.5 If a wage scale prepared by the U.S. Department of Labor pursuant to the provision of the Davis-Bacon Act is included in the Contract Documents, such wage scale represents the minimum wages that must be paid in each category of labor on the project. The requirements and responsibilities within the Davis-Bacon Act apply to this project.

§ 3.4.6 Insert the following:

§ 3.4.6 EQUAL EMPLOYMENT OPPORTUNITY
During the performance of this contract, the contractor agrees as follows:

§ 3.4.6.1 The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, including transgender status or gender expression, national origin or citizenship status, ancestry, age, disability, genetic information, or veterans status. Such action shall include, but not be limited to, the following: employment, upgrading, demotions, transfers, recruitment or recruitment advertising; layoffs or terminations; rates of pay or other forms of compensation; and selection for training, including apprenticeship.

§ 3.4.6.2 The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, including transgender status or gender expression, national origin or citizenship status, ancestry, age, disability, genetic information, or veterans status.

§ 3.4.6.3 The contractor will send to each labor union or representative of the workers with which there is a collective or bargaining agreement in place, or other contract or understanding, whereby labor is being furnished for the performances of his contract, a notice, as set forth in Attachment A attached hereto, to be provided by the contracting department or agency, advising the said labor union or workers' representative of the contractor's commitment under the provisions of the contract, and shall post copies of the notice in conspicuous places available to employees and to applicants for employment.

§3.4.6.4 The contractor will cause the foregoing provisions to be inserted in all contracts for any work covered by this agreement so that such provisions will be binding upon each subcontractor.

§ 3.4.6.5 Contractors and subcontractors with contracts in excess of $50,000 will also pursue in good faith affirmative action programs.

§ 3.6.1 Insert the following:

§ 3.6.1 The University of Maine System is exempt from payment of taxes under the Maine Sales and Use Tax Law Title 36 Section 1760 for taxes on materials that

are permanently incorporated into the real property belonging to the University of Maine System. The University of Maine System is also exempt from the payment of Federal Excise Taxes on articles not for resale and from the Federal Transportation Tax on all shipments; exemption certificates for these taxes will be furnished when required. All quotations shall be less these taxes. The contractor shall pay all other taxes that have been or are legally enacted.

§ 3.7.4 Replace the existing § 3.7.4 with the following:

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

§3.10.1.1 Insert the following:

§ 3.10.1.1 The Contractor shall provide an updated Construction Schedule with each Application for Payment reflecting actual construction progress and activities.

§ 3.12.11 Insert the following:

§ 3.12.11 The Architect's review of the Contractor's submittals will be limited to examination of an initial submission and two (2) resubmittals. The Architects review of additional submittals will be made only with the consent of the Owner after notification by the Architect. The Owner shall deduct from the next payment made from the Contract Sum amounts paid to the Architect for evaluation of such additional submittals.

§ 3.15.3 Insert the following:

§ 3.15.3 Waste Management The University is committed to a resource management strategy which reduces to a minimum the production of waste material while reusing, recycling or composting as much as possible of the remaining materials. Contractor should strive to identify opportunities to reduce, reuse, or recycle waste from renovations or new construction, and will submit a construction waste management plan for the project.

§ 4.1.1 Replace the existing § 4.1.1 with the following:

> **§ 4.1.1** The Architect is a person or entity lawfully licensed to practice in the State of Maine. That person or entity is identified in the Agreement and is referred throughout the Contract Documents as if singular in number. Whenever the prime professional designer for the Work is an Engineer, the term Architect, wherever used in these documents shall have the term Engineer substituted for the term Architect. The Engineer shall be lawfully licensed to practice engineering in the State of Maine or an entity lawfully practicing engineering identified as such in the Agreement.

§ 4.2.1 Replace the existing § 4.2.1with the following:

> **§ 4.2.1** The Architect will provide administration of the Contract as described in the Contract Documents, and will be an Owner's representative during construction until the date the final payment is due, and from time to time during the period for correction of Work described in § 12.2, and until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 Replace the existing § 4.2.2 with the following:

> **§ 4.2.2** The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, endeavor to guard the Owner against defects and deficiencies in the Work, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.
>
> **§ 4.2.2.1** The Contractor shall reimburse the Owner for compensation paid to the Architect for additional site visits made necessary by the fault, neglect as determined solely by the Owner, or request of the Contractor. The reimbursement shall be deducted from the next payment made from the Contract Sum following the Owner's payment to the Architect.

§ 4.2.3 Delete the word "reasonably" from the first sentence.

§ 4.2.10 Replace the existing § 4.2.10 with the following:

> **§ 4.2.10** If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in the contract between the Architect, AIA B102 and B201-2007and Supplemental Requirements to be incorporated in the Contract Documents and attached hereto as Exhibit A.

§ 5.2.1 Add the following:

§ 5.2.1.1 The Contractor shall provide Owner 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. The list shall be presented at the preconstruction meeting and, when changes occur, at each requisition meeting as necessary. Information from this list will be placed on Owner's web site and updated as needed as required by 26 MRSA §1302-A.

§ 5.2.1.2 Where the use of the Maine Bid Depository was required by the Procurement Requirements, Subcontractors included in the Contractor's Proposal shall be the Subcontractors for the defined Work unless a change has been approved by the Owner.

§ 7.1.4 Insert the following:

§ 7.1.4 The combined overhead and profit included in the total cost to the Owner of a change in the Work shall be based on a previously agreed upon unit pricing or on the following schedule allowing for appropriate allowances for contract duration:

.1 For the Contractor, for Work performed by the Contractor's own forces, 20% of the cost.

.2 For the Contractor, for Work performed by the Contractor's Subcontractors, 10% of the amount due the Subcontractors.

.3 For each Subcontractor involved, for Work performed by the Subcontractor's own forces, 20% of the cost.

.4 For each Subcontractor involved, for Work performed by the Subcontractor's Sub-subcontractors, 10% of the amount due the Sub-subcontractor.

.5 Costs to which overhead and profit is to be applied shall be limited to the following:

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

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

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

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

§ 7.1.5 When there is only an extension of Contract Time, the contractor delay claim is limited to additional costs related to supervision and field office personnel, which may be included in the overhead and profit calculation.

§ 7.1.6 In order to facilitate checking of quotations, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by complete itemization of costs including labor, materials and Subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they are to be itemized also. In no case will a change be approved without such itemization.

§ 9.3.1.3 Insert the following:

§ 9.3.1.3 The provisions of Title 5 M.R.S.A § 1746, as amended, pertain to this project. The University shall retain five percent (5%) of each payment due the Contractor as part of the security for the fulfillment of the Contract Agreement by the Contractor, the Contractor shall not withhold a greater percentage from subcontractors. The University may, if deemed expedient by the University, cause the Contractor to be paid temporarily or permanently from time to time during the progress of the work, such portion of the amount retained as the University deems prudent or desirable.

§ 9.5.1 The word "shall" will be substituted for the word "may" in all places in § 9.5.1.

§ 9.5.1.1 Replace with the following:

§ 9.5.1.1 Defective Work, i.e. Work that does not conform to the requirements of the contract, shall include, but not be limited to, non-conforming Work, disputed Work, incomplete Work, and unacceptable Work, which is not remedied.

§ 9.5.1.1.1 The Architect shall deduct and withhold from any certification for payment an amount equal to one hundred and fifty percent (150%) the value of any defective Work.

§ 9.6.8 Insert the following:

§ 9.6.8 All Progress Payments and Final Payment are subject to the requirements of the "Maine Prompt Pay Act" Title 10 M.R.S.A. § 201-A, as amended. Payments shall be made on a timely basis in accord with the requirements of this Statute; however, the Contractor waives interest on any late payment.

§ 9.10.1.1 Insert the following:

§ 9.10.1.1 Except with the consent of the Owner, the Architect will perform no more than three (3) site reviews to determine whether the Work or a designated portion thereof has attained Final Completion in accordance with the Contract Documents. The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect for any additional site reviews.

§ 9.11 Insert the following:

§ 9.11 The Contractor and the Contractor's surety, if any, shall be liable for and shall pay the Owner the sums stipulated as liquidated damages in the Contract Documents for each calendar day of delay after the date established for Substantial Completion in the Contract Documents until the Work is substantially complete.

§10.2.1 Add the following:

.4 If this Contract involves renovation, repair, or preparation of surfaces for painting in pre-1978 apartments, houses, or spaces used by child care facilities, Contractor shall use certified workers who follow the lead-safe work practices as required by the US Environmental Protection Agency's Renovation, Repair and Remodeling rule described in 40 CFR § 745.85. Notification of the tenants or users under this rule will be the responsibility of the University.

§ 10.3.2 Replace the existing §10.3.2 with the following:

§ 10.3.2 Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor.

§ 11.1.3 Add the following:

Certificates of Insurance filed with the University of Maine System shall indicate the Certificate Holder as University of Maine System, 16 Central Street, Bangor, Maine 04401. The Project name, campus, and general liability insurance required policy form and two required endorsements noted in Paragraph 11.1.5.1 below shall be included on the Certificate. Contractor must provide renewal certificates at least 15 days prior to expiration.

§ 11.1.4 Add the following:

Neither the Contractor nor any Subcontractors or Suppliers shall commence work at the project site under this contract until the Contractor has provided the University with a standard ACORD certificate with an attached AIA Document G715-1991 listing all insurance coverages and limits required under this section. All required insurance shall be maintained throughout the term of this contract (including correction period, defined in 12.2.2.1) and be on a primary basis, noncontributory with any other insurance carried by the University. All required insurance shall be provided by companies that have a current A.M. Best insurance rating of A- or better and that are licensed or approved to do business in the State of Maine.

§ 11.1.5 Insert the following:

§ 11.1.5 COVERAGE LIMITS - The required insurance and coverage limits are as follows:

§ 11.1.5.1 General Liability -Contractor shall provide General Liability insurance with coverage for premises and operations, products and completed operations, explosion, collapse and underground hazards, broad form property damage, contractual, personal and advertising injury liabilities. Insurance shall be provided on a standard Insurance Services Office (ISO) Commercial General Liability Form CG 00 01 12 04 or equivalent and shall include the following three endorsements or their equivalent: 1) Additional Insured—Owners, Lessees or Contractors—Scheduled Person or

Organization (CG20 10 07 04) with the University of Maine System, 16 Central Street, Bangor, ME 04401 listed as additional insured; 2) Additional Insured—Owners, Lessees or Contractors—Completed Operations (CG 20 37 07 04) with the University of Maine System, 16 Central Street, Bangor, ME 04401 listed as additional insured; and 3) Designated Construction Project General Aggregate Limit (CG 25 03 03 97)) as the Aggregate limits shall apply on a per location or job basis. The policy form and endorsements must be included on the certificate of insurance. The below required minimum insurance limits shall not be construed as a limitation of the University's rights under any insurance with higher limits and no insurance shall be endorsed to include such a limitation. General Liability insurance required minimum limits:

.1 General Aggregate	$2,000,000
.2 Products & Completed Operations Aggregate	$2,000,000
.3 Personal Injury Aggregate	$1,000,000
.4 Each Occurrence for Contracts Under $1 million	$1,000,000
.5 Each Occurrence for Contracts $1 million and above	$2,000,000
.6 Personal/Advertising Injury	$1,000,000
.7 Medical Payments (Any One Person)	$5,000

§ 11.1.5.2 Workers' Compensation - Contractor including Independent Contractors shall provide Worker's Compensation insurance with coverage on a statutory basis according to Maine Law and apply to all personnel on the job site. Workers' Compensation insurance required minimum limits:

.1 Coverage A (Workers' Compensation)	Statutory Limits
.2 Coverage B (Employers Liability)	
.1 Bodily injury by accident	$500,000 each accident
.2 Bodily injury by disease	$500,000 each employee
.3 Bodily injury by disease	$500,000 policy limit

§ 11.1.5.3 Vehicle Liability Insurance - Contractor shall provide Vehicle Liability insurance with coverage for all owned, hired/rented and non-owned vehicles. Vehicle Liability insurance required minimum limit:

.1 Combined Single Limit	$1,000,000 each accident
or	
.2 Split Limits	$1,000,000 bodily injury $1,000,000 property damage

§ 11.3.1 Replace all of the existing § 11.3.1 and its subparagraphs with the following:

[NOTE: THE PROJECT MANAGER WILL MANUALLY DELETE FROM THIS SECTION THE ONE NOT SELECTED TO DESCRIBE THE TYPE OF PROJECT.]

[FOR NEW, STAND-ALONE CONSTRUCTION AND MAJOR ADDITIONS USE THIS PARAGRAPH. Use for stand-alone buildings and major additions with fire walls and fire doors separating the addition from the existing building:]

§ 11.3.1 The Contractor shall secure "All Risk" type Builder's Risk Insurance,

appropriate for the Project, with an insurance company lawfully authorized to do business in the State of Maine, and shall maintain said insurance during the contract time. The insurance shall be written on a replacement cost basis and the amount of the insurance shall not be less than the full replacement cost of the Project and Project materials. The insurance shall cover, at a minimum, losses due to fire, smoke, explosion, hail, lightning, theft, vandalism, malicious mischief, wind, collapse, riot, aircraft, and increased cost of construction. Insurance shall also cover portions of the work located away from the site but intended for use at the site, and for portions of the work in transit. In the event of a loss, the insurance deductible and any uncovered loss will be assumed by the Contractor. The insurance shall name as the insured the Contractor, the Subcontractors, the Designer, and the University. The policy must be written as the primary insurance covering the project and include endorsement providing permission to occupy in advance of project completion. A certificate of insurance verifying coverage shall be forwarded simultaneously to the Designer and the University prior to starting any work at the site. If the Contractor fails to maintain the appropriate insurance, then the Contractor shall bear all reasonable costs attributed to that failure.

[FOR RENOVATION, ALTERATION AND/OR ADDITION WORK USE THIS PARAGRAPH:]

§ 11.3.1 For this project, Property Insurance coverage, up to the total amount of the Project, will be provided by the University by adding the Project to the University's existing master property insurance. Coverage shall be included for the Contractor and all Subcontractors, as their interests may appear, while involved in the Project and until the work is completed or the contractor is otherwise advised in writing. This insurance is limited to the "all risk" type coverage provided under the University's master property insurance for direct physical loss or damage to the building or building materials related to the project, subject to standard policy limitations and exclusions. The contractor is responsible for a $10,000 per claim deductible. Any other insurance desired by the Contractor beyond that covered by the University's insurance, or to cover the $10,000 deductible, is the responsibility of the Contractor. This contract stands as verification of the University's property insurance coverage on the project and no further verification will be provided.

§ 11.4.1 Replace the existing §11.4.1 with the following:

§ 11.4.1 The Contractor shall furnish a Performance Bond and a Payment Bond covering the faithful performance of the contract and payment of obligations arising thereof. Bonds may be obtained through the Contractor’s usual source and the cost thereof shall be included in the Contract Sum. The amount of each bond shall be equal to 100% of the Contract Sum. Should the Contract Sum change during the contract and warranty periods, the amount of the Bonds will be changed to reflect the Contract Sum.

§ 11.4.1.1 The Contractor shall deliver the required bonds to the Owner at the same time as the signed Contract Agreement is delivered to the Owner. Prior to the commencement of the Work, the Contractor shall submit satisfactory evidence that such bonds will be furnished.

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

of attorney.

§ 11.4.1.3 The Contract Bonds shall continue in effect for one year after final acceptance of each 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.

§ 13.6 Delete §13.6 in its entirety.

§ 14.1.1.4 Delete §14.1.1.4 in its entirety.

§ 14.1.3 Delete the words "and damages"

§ 14.4.3 Replace the existing §14.4.3 with the following:

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

§ 15.4.1 Replace the existing §15.4.1 with the following:

§ 15.4.1 The parties have selected arbitration as the method for binding dispute resolution in this Agreement, any claim, dispute or other matter in question arising out of or related to this Agreement subject to, but not resolved by, mediation shall be subject to arbitration, which unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of this Agreement, except that the parties shall select only one Arbitrator, and there shall be no discovery. A demand for arbitration shall be made in writing, delivered to the other party to this Agreement, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be defended.

THE MAINE HUMAN RIGHTS ACT GUARANTEES…

Equal Employment Rights

EQUAL EMPLOYMENT RIGHTS

1. The RIGHT to freedom from discrimination in employment.
2. The opportunity for an individual to secure employment without discrimination… is declared to be a CIVIL RIGHT.

The Maine Human Rights Act prohibits discrimination because of race, color, sex, sexual orientation, age, physical or mental disability, genetic pre-disposition, religion, ancestry or national origin.

The Maine Human Rights Act also prohibits discrimination because of filing a claim or asserting a right under the Worker's Comp Act or retaliation under the Whistleblower's Act.

UNLAWFUL EMPLOYMENT DISCRIMINATION

1. For any employer to fail or refuse to hire an applicant
2. For any employer to discharge an employee
3. For any employer to discriminate against an employee with respect to recruitment, tenure, promotion, transfer, or compensation
4. For any employment agency to fail or refuse to classify properly or refer for employment an applicant
5. For any labor organization to exclude from apprenticeship or membership an applicant
6. For any employer, employment agency, or labor organization prior to employment or admission to membership of an individual to ask questions, keep as record, use application form, issue any notice, employ a quota system
7. For any employer, employment agency, or labor organization to retaliate against a person who has opposed a violation of the Maine Human Rights Act

Because of race, color, sex, sexual orientation, age, physical or mental disability, genetic pre-disposition, religion, ancestry or national origin or because of asserting a claim under the Worker's Comp Act or Whistleblower's Act.

MAINE=
HUMAN RIGHTS
COMMISSION

IF YOU FEEL YOU HAVE BEEN DISCRIMINATED AGAINST, CONTACT THE COMMISSION OFFICE.
51 STATE HOUSE STATION, AUGUSTA, MAINE 04333-0051
PHONE (207) 624-6050 FAX (207) 624-6063 TTY 1-888-577-6690

(Rev. Dec. 28, 2005) **Printed under appropriation: 01094H1010012**

Attachment A

Schedule of Liquidated Damages

Liquidated damages (a fixed amount set forth in the contract) agreed to by the owner and the contractor are intended to compensate the owner for unexcused delay in the performance of the contract. The parties agree that the purpose of the liquidated damages schedule below is to establish, in advance, a reasonable estimate of the damages that would be incurred by the owner if there is an unexcused delay, or a breach of contract, which causes the work to be extended beyond the contractual substantial completion date. This agreement of liquidated damages by the parties is made to establish the reasonableness of them to the actual damages an owner may have incur due to unexcused delays by the contractor, even though the actual damages may be an uncertain amount and unprovable.

The specific per diem rates for Liquidated Damages are **$1,250 as set forth below**. By executing the Contract, the Contractor acknowledges that such an amount is not a penalty and that the daily amount set forth in the Contract is a reasonable per diem forecast of damages incurred by the Owner due to the Contractor's failure to complete the Work within the Contract Time.

Original Contract Amount		Per Diem Amount of Liquidated Damages
From	To	
More Than	and Including	
0	$100,000	$500
$100,000	$300,000	$675
$300,000	$500,000	$750
$500,000	$1,000,000	$825
$1,000,000	$2,000,000	$1,000
$2,000,000	$4,000,000	$1,250
$4,000,000	and more	$1,500

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THIS DOCUMENT MUST BE CLEARLY POSTED AT THE PERTAINING STATE FUNDED PREVAILING WAGE CONSTRUCTION SITE

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

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

Title of Project --------Portland Central Heat Plant 6100195

Location of Project –Portland, Cumberland County

2014 Fair Minimum Wage Rates
Building 2 Cumberland County
(other than 1 or 2 family homes)

Occupation Title	Minimum Wage	Minimum Benefit	Total	Occupation Title	Minimum Wage	Minimum Benefit	Total
Asbestos/Lead Removal Worker	$12.50	$0.33	$12.83	Ironworker - Structural	$20.00	$2.76	$22.76
Backhoe Loader Operator	$18.00	$2.43	$20.43	Laborers (Incl.Helpers & Tenders)	$12.55	$0.33	$12.88
Boom Truck (Truck Crane) Operator	$26.50	$15.46	$41.96	Laborer - Skilled	$15.00	$1.02	$16.02
Bricklayer	$23.15	$0.00	$23.15	Loader Operator - Front-End	$17.88	$3.12	$21.00
Bulldozer Operator	$17.98	$2.55	$20.53	Mechanic- Maintenance	$25.50	$1.87	$27.37
Carpenter	$19.50	$2.53	$22.03	Mechanic- Refrigeration	$22.00	$4.04	$26.04
Carpenter - Acoustical	$13.88	$2.97	$16.85	Millwright	$26.58	$16.85	$43.43
Carpenter - Rough	$19.00	$1.88	$20.88	Oil/Fuel Burner Servicer & Installer (Licensed)	$21.93	$7.38	$29.31
Cement Mason/Finisher	$17.75	$0.00	$17.75	Painter	$14.00	$0.00	$14.00
Communication Equip Installer	$22.50	$3.95	$26.45	Paver Operator	$17.25	$1.63	$18.88
Concrete Pump Operator	$20.50	$3.53	$24.03	Pipe/Steam/Sprinkler Fitter	$25.00	$13.84	$38.84
Crane Operator <15 Tons	$19.50	$4.66	$24.16	Plumber (Licensed)	$24.50	$3.40	$27.90
Crane Operator =>15 Tons)	$23.00	$4.36	$27.36	Plumber Helper/Trainee (Licensed)	$17.00	$2.61	$19.61
Crusher Plant Operator	$17.00	$4.06	$21.06	Propane & Natural Gas Servicer & Inst	$23.00	$3.44	$26.44
Driller - Well	$14.00	$3.20	$17.20	Pump Installer	$21.00	$2.77	$23.77
Dry-Wall Applicator	$21.00	$1.55	$22.55	Rigger	$20.00	$5.35	$25.35
Dry-Wall Taper & Finisher	$20.50	$0.80	$21.30	Roller Operator - Pavement	$17.25	$5.41	$22.66
Electrician - Licensed	$25.00	$6.44	$31.44	Roofer	$16.00	$1.69	$17.69
Electrician Helper/Cable Puller (Licensed)	$15.00	$2.77	$17.77	Sheet Metal Worker	$19.59	$3.09	$22.68
Elevator Constructor/Installer	$51.42	$30.35	$81.77	Sider	$16.00	$1.11	$17.11
Excavator Operator	$17.00	$2.26	$19.26	Stone Mason	$18.00	$0.77	$18.77
Flagger	$11.50	$0.00	$11.50	Tile Setter	$22.05	$3.73	$25.78
Floor Layer	$15.70	$1.96	$17.66	Truck Driver - Light	$16.00	$4.13	$20.13
Glazier	$26.00	$2.47	$28.47	Truck Driver - Medium	$15.00	$1.30	$16.30
HVAC	$24.55	$3.39	$27.94	Truck Driver - Heavy	$14.25	$0.71	$14.96
Insulation Installer	$18.50	$3.32	$21.82	Truck Driver - Tractor Trailer	$16.00	$4.21	$20.21
Ironworker - Reinforcing	$20.88	$1.00	$21.88	Truck Driver - Mixer (Cement)	$13.28	$0.84	$14.12

The Laborer classifications include a wide range of work duties. Therefore, if any specific occupation to be employed on this project is not listed in this determination, call the Bureau of Labor Standards at the above number for further clarification.

Welders are classified in the trade to which the welding is incidental.

Apprentices - The minimum wage rate for registered apprentices are those set forth in the standards and policies of the Maine State Apprenticeship and Training Council for approved apprenticeship programs.

Posting of Schedule - Posting of this schedule is required in accordance with 26 MRSA §1301 et. seq., by any contractor holding a State contract for construction valued at $50,000 or more and any subcontractors to such a contractor.

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 with the Secretary of State.

Determination No: B2-114-2014

Filing Date: October 21, 2014

Expiration Date: 12-31-2014

A true copy

Attest: Pamela Megathlin

Pamela D Megathlin
Director
Bureau of Labor Standards

BLS 424BU (R2014) (Building 2 Cumberland)

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SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Work covered by the Contract Documents.
   2. Type of the Contract.
   3. Work schedule.
   4. Work under other contracts.
   5. Use of premises.
   6. Owner's occupancy requirements.
   7. Work restrictions.
   8. Specification formats and conventions.

B. Related Sections include the following:
   1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: USM Central Heat Plant Upgrades.
   1. Project Location: Portland, Maine.
   2. USM Project Number: USM Project 2012-016

B. Owner: University of Maine System for the University of Southern Maine.

C. Architect: Harriman, 46 Harriman Drive, Auburn, ME.

1.4 TYPE OF CONTRACT

A. Project will be constructed under a single prime contract.

1.5 PERMITS

A. The Contractor is responsible for electrical permit and plumbing permit and for obtaining the Certificate of Occupancy from authorities having jurisdiction. Owner will be responsible for obtaining building permits from the City of Portland.

1.6 WORK SCHEDULE

A. Commencement:
   1. Facility will be available for construction starting on or about May 30, 2015.

B. Substantial completion date for the work:
   1. The work shall be substantially complete on or before September 1, 2015.

2. Final completion, including completion of punch list items shall be done on or before October 1, 2015.

C. Before commencing Work of each phase, submit a schedule showing the sequence, commencement and completion dates, and move-out and -in dates of Owner's personnel for all phases of the Work.

1.7 WORK UNDER OTHER CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

1.8 USE OF PREMISES

A. General: Contractor shall have limited use of premises for construction operations necessary for Work shown on Drawings.

B. Use of Site: Limit use of premises to areas required for Work shown on Drawings. Do not disturb portions of Project site beyond areas in which the Work is indicated.
   1. Owner Occupancy: Allow for Owner occupancy and public use of all spaces within campus center and exterior facilities and features adjacent to the Work.
   2. Driveways and Entrances: Keep driveways, parking, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
      a. Schedule deliveries to minimize use of driveways and entrances.
      b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Use of Existing Building: Maintain existing building in a weather tight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

D. Campus Tobacco Use Policy: A tobacco-free campus has been established at The University of Southern Maine to provide a healthy working and learning environment for the entire campus community.
   1. The University of Southern Maine is a tobacco-free campus. This policy applies to faculty, staff, students, contractors, vendors and visitors. The use of tobacco and all smoking products is not permitted on any university-owned property, which includes but is not limited to, buildings, university grounds, parking areas, campus walkways, recreational and sporting facilities, and university or personally-owned, rented or leased vehicles.
   2. Tobacco use by definition includes the possession of any lighted tobacco products, or the use of any type of smokeless tobacco, including but not limited to chew, snuff, snus, electronic cigarettes, and all other nicotine delivery devices that are non-FDA approved as cessation products.
   3. It is the shared responsibility of all members of the campus community to respect and abide by this policy. The successful implementation of this policy depends on the courtesy and cooperation of the entire campus community.

E. Contractor access to building and site: Project keys and/or access cards shall be issued to the Contractor for the duration of the project. The Contractor assumes all liability for lost keys or cards. This includes all cost (material and labor) associated with rekeying buildings. Final

payment for services provided under this contract will not be made until all issued keys and cards are returned. Complete USM Key Policy can be found at http://usm.maine.edu/facilities/updated-usm-key-policy.

1.9 OWNER'S OCCUPANCY REQUIREMENTS

A. Full Owner Occupancy: Owner will occupy site and existing adjacent buildings during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits, unless otherwise indicated.
   1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
   2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

B. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
   1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.
   2. Contractor shall obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
   3. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of building.
   4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

1.10 WORK RESTRICTIONS

A. On-Site Work Hours: Work shall be generally performed inside the existing building during normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, except otherwise indicated.
   1. Early Morning Hours: Contractor allowed access to site during early morning hours (prior to 7:00 am) upon request and approval of the owner.

B. Existing Utility Interruptions: 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 and Owner not less than three days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Owner's written permission.
   3. Shutdowns shall be scheduled during after hours, when the facility is not occupied.

1.11 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's "2004 MasterFormat" numbering system.
   1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
   2. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
   1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
   2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
      a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.12 MISCELLANEOUS PROVISIONS

A. Material safety data sheets shall be made available in accordance with OSHA requirements.

B. No asbestos containing materials shall be used in the work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

B. Types of allowances include the following:

1. Building Management System

1.3 COORDINATION

A. Coordinate allowance items with other portions of the Work.

1.4 LUMP-SUM ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner under allowance.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Lump-Sum Allowance: Include the sum of $138,211.00 for Building Automation System (BAS) controls as specified in Section 230900 “INSTRUMENTATION AND CONTROL FOR HVAC” This work will be provided by IB Controls and is assigned to the general contractor as part of their contractual obligations.

1. Contactor is responsible for scheduling and coordinating this work.

END OF SECTION 012100

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
   1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.
   2. Hold pricing for 90 days from date of bid to allow Owner time for project accounting. Alternates not accepted before contract signing may be added by Change Order later.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
   1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A Schedule of Alternates is included at the end of this Section.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No.1 – Remove existing chimney foundation to 12” below finished grade and cover with 6” sand and 6” loam & seed.

B. Alternate No. 2 – Delete type A* and A1* lighting fixtures and replace with six salvaged T5 highbay troffer type fixtures. Also delete lighting control system and all wiring and components. Retrofit and install six existing salvaged fixtures and provide line voltage control. Also provide time clock and photocell control for exterior light fixtures. Provide all connections as required.

END OF SECTION 012300

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections include the following:
   1. Division 01 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.3 MINOR CHANGES IN THE WORK

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

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
   2. Within 20 days after receipt of Proposal Request or earlier as specified in Proposal Request issued, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
      a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include costs of labor and supervision directly attributable to the change.
      d. Include quotes on supplier’s and subcontractor’s letterhead for the requested change.
      e. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float time before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Architect.
   1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
   2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   4. Include costs of labor and supervision directly attributable to the change.
   5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float time before requesting an extension of the Contract Time.
   6. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

C. Proposal Request Form: Use AIA Document G709 for Proposal Requests, or format as approved by the Owner.

1.5 ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, base each Change Order proposal on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
   1. Include installation costs in purchase amount only where indicated as part of the allowance.
   2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
   3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
   4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the Purchase Order amount or Contractor's handling, labor, installation, overhead, and profit. Submit claims within 21 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. Owner will reject claims submitted later than 21 days after such authorization.
   1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
   2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

1.6 CHANGE ORDER PROCEDURES

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

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714 . Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
   1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
   1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

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SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Sections include the following:
   1. Division 01 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
   2. Division 01 Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.

1.3 DEFINITIONS

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

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
   1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
      a. Application for Payment forms with Continuation Sheets.
      b. Submittals Schedule.
      c. Contractor's Construction Schedule.
   2. Submit the Schedule of Values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
      a. Submit Schedule of Values to the Architect in electronic format for review, comment and approval by the Owner.
   3. Subschedules: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
   1. Cover Sheet Identification: Include the following Project identification on the Schedule of Values:
      a. Project name and location.
      b. Name of Architect.
      c. Architect's project number.
      d. Contractor's name and address.

e. Date of submittal.
f. Certification that Record Drawings have been updated and verified.

2. Submit draft of Continuation Sheets.
3. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
   a. Related Specification Section or Division.
   b. Description of the Work.
   c. Name of subcontractor.
   d. Name of manufacturer or fabricator.
   e. Name of supplier.
   f. Change Orders (numbers) that affect value.
   g. Dollar value.
      1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents, providing at least one line item for each Specification Section. Provide several line items for principal subcontract amounts, where appropriate.
   a. For each line item, provide a sublist breakdown as follows:
      1) Material.
      2) Labor.
5. For Division 15 work, provide the following additional line item breakdown of the mechanical subcontractor's work for each Application for Payment.
   a. Ductwork Systems.
   b. HVAC Piping Systems.
   c. HVAC Equipment.
   d. HVAC Controls.
   e. Plumbing, including fixtures and piping.
6. Documentation: Submit proper documentation for the amounts being requisitioned from subcontractors and material suppliers with each Application for Payment.
7. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
8. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
   a. Differentiate between items stored on-site and items stored off-site. If specified, include evidence of insurance or bonded warehousing.
   b. Only major long lead delivery items may be considered for off-site storage (Example: Long lead custom mechanical unit). Standard order and production materials and products shall be delivered to the site before including in Application of Payment on such items.
9. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
10. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
11. Each item in the Schedule of Values and Applications for Payment shall be complete.
    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.

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

C. The Contractor shall furnish to the Architect at the beginning of the project an expected monthly requisition estimate for the Owner's use in planning funding.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
   1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: Progress Payment Applications shall be submitted to Architect not less than 7 days before monthly progress meeting. The period covered by each Application for Payment is one month, ending on the last day of the month.
   1. Submit electronic copy to Architect and to Owner for review and comment at least 7 days before monthly progress meeting. Upon receipt of review comments, prepare notorized paper copies and transmit for signing at the progress meeting.

C. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
   1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
   2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
   1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
   2. Submit one electronic copy of Application for Payment.

F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
   1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
   2. When an application shows completion of an item, submit final or full waivers.
   3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
   4. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
   5. Waiver Forms: Submit waivers of lien on University of Maine System Wavier of Lien form, executed in a manner acceptable to Owner.

G. Record Drawing Updates: With each Application of Payment, record documents shall be maintained and current for all trades, available for viewing at a central location.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
   1. List of subcontractors.
   2. Schedule of Values.
   3. Contractor's Construction Schedule (preliminary if not final).
   4. Products list.
   5. Schedule of unit prices.
   6. Submittals Schedule (preliminary if not final).
   7. List of Contractor's staff assignments.
   8. List of Contractor's principal consultants.
   9. Copies of building permits and other required permits.
   10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
   11. Initial progress report.
   12. Report of preconstruction conference.
   13. Certificates of insurance and insurance policies.
   14. Performance and payment bonds.

I. Progress Applications for Payment: Administrative actions and submittals that must precede or coincide with submittal of progress Applications for Payment include the following:
   1. Contractor's Construction Schedule update.
   2. Submittals for Work being requisitioned for are complete and approved.
   3. Submit list of completed tests, checklists, commissioning, reports and similar requirements for the work are submitted and in compliance with the Contract Documents.
   4. Minutes of previous month’s progress meeting have been distributed.
   5. Record drawings are current.
   6. Wage and benefit records of Contractor and all subcontractors and sub-subcontractors for the period covered by the Application for Payment.

J. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion less retainage, for portion of the Work claimed as substantially complete.
   1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
   2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

K. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
   1. Evidence of completion of Project closeout requirements, record documents, operation and maintenance data, and demonstration and training.
   2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
   3. Updated final statement, accounting for final changes to the Contract Sum.
   4. University of Maine System - Certificate of Completion
      a. Application of Final Payment
      b. Affidavit of Payments (AIA G706 or equal) including separate releases or waivers of liens from subcontractors and materials and equipment suppliers.

c. Consent of Surety (AIA G707 or equal)
d. Release of Liens (AIA G706A or equal)
e. University of Maine System – Waiver of Lien

5. Evidence that claims have been settled.
6. Submission of Waste Reporting Sheets and Waste Handling Certificates.
7. Final liquidated damages settlement statement.
8. Return keys and building access cards issued to Contractor for construction purposes to Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

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SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections include the following:
   1. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's Construction Schedule.
   2. Division 01 Section "Execution Requirements" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
   3. Division 01 Section "Closeout Procedures" for coordinating Contract closeout.

1.3 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.
   4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical. Coordinate location of pipes, conduits, ducts and similar items in confined areas to assure proper fit and access. Contractor is responsible for handling interferences created by the work of subcontractors (example, sprinkler pipe interfering with installation of duct work; duct work interfering with installation of tight fixtures).

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

C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
   1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Contractor's Construction Schedule.
   2. Preparation of the Schedule of Values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Preinstallation conferences.
   7. Project closeout activities.
   8. Startup and adjustment of systems.
   9. Project closeout activities.

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

1.4 SUBMITTALS

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

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
   1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

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

1.6 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
   1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
   2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
   3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

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

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
   1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
   2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
      a. The Contract Documents.
      b. Options.
      c. Related requests for interpretations (RFIs).
      d. Related Change Orders.
      e. Purchases.
      f. Deliveries.
      g. Submittals.
      h. Review of mockups.
      i. Possible conflicts.
      j. Compatibility problems.
      k. Time schedules.
      l. Weather limitations.
      m. Manufacturer's written recommendations.
      n. Warranty requirements.
      o. Compatibility of materials.
      p. Acceptability of substrates.
      q. Temporary facilities and controls.
      r. Space and access limitations.
      s. Regulations of authorities having jurisdiction.
      t. Testing and inspecting requirements.
      u. Installation procedures.
      v. Coordination with other work.
      w. Required performance results.
      x. Protection of adjacent work.
      y. Protection of construction and personnel.
      z. Record drawing process.
   3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
      a. Include action items and responsible party.
   4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
   5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Monthly Progress Meetings: Conduct progress meetings at monthly intervals. Coordinate dates of meetings with preparation of payment requests.
   1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
        1) Review schedule for next period.
    b. Application for Payment: Contractor shall bring copy of Application for Payment to meeting. Review Application for Payment and required attachments, record drawing and documents status, waivers of mechanic's liens, list of completed tests, checklists, commissioning, reports, and similar requirements for the work are submitted and in compliance with the Contract Documents.
    c. Review present and future needs of each entity present, including the following:
        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Deliveries.
        5) Off-site fabrication.
        6) Access.
        7) Site utilization.
        8) Temporary facilities and controls.
        9) Work hours.
        10) Hazards and risks.
        11) Progress cleaning.
        12) Quality and work standards.
        13) Status of correction of deficient items.
        14) Field observations.
        15) Requests for interpretations (RFIs).
        16) Status of proposal requests.
        17) Pending changes.
        18) Status of Change Orders.
        19) Pending claims and disputes.
        20) Documentation of information for payment requests.
3. Minutes: Record and distribute the meeting minutes.
    a. Include action items and responsible party.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
    a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

E. Coordination/Progress Meetings: Conduct Project coordination/progress meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
1. Attendees: In addition to representatives of Owner, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work

2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to Combined Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    b. Schedule Updating: Revise Combined Contractor's Construction Schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    c. Review present and future needs of each contractor present, including the following:
        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Deliveries.
        5) Off-site fabrication.
        6) Access.
        7) Site utilization.
        8) Temporary facilities and controls.
        9) Work hours.
        10) Hazards and risks.
        11) Progress cleaning.
        12) Quality and work standards.
        13) Change Orders.
3. Conduct coordination meetings with the mechanical, plumbing, sprinkler and electrical trades. Before the trades start work in an area of the building, review structural clearances and locations of ducts, pipes, conduits, light fixtures, equipment and other items that affect location and proper fit. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components. Verify depths and clearances before fabrication of ductwork.
4. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.
    a. Include action items and responsible party.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Preliminary Construction Schedule.
   2. Contractor's Construction Schedule.
   3. Submittals Schedule.
   4. Field condition reports.
   5. Special reports.

B. Related Sections include the following:
   1. Division 1 Section "Payment Procedures" for submitting the Schedule of Values.
   2. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
   3. Division 1 Section "Submittal Procedures" for submitting schedules and reports.
   4. Division 1 Section "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
   1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
   2. Predecessor Activity: An activity that precedes another activity in the network.
   3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the Schedule of Values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum, unless otherwise approved by Architect.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.
   1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
   2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
   3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

H. Major Area: A story of construction, a separate building, or a similar significant construction element.

I. Milestone: A key or critical point in time for reference or measurement.

J. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.

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

1.4 SUBMITTALS

A. Submittals Schedule: Submit three copies of schedule. Arrange the following information in a tabular format:
   1. Scheduled date for first submittal.
   2. Specification Section number and title.
   3. Submittal category (action or informational).
   4. Name of subcontractor.
   5. Description of the Work covered.
   6. Scheduled date for Architect's final release or approval.

B. Preliminary Construction Schedule: Submit two copies.
   1. Approval of cost-loaded preliminary construction schedule will not constitute approval of Schedule of Values for cost-loaded activities.

C. Preliminary Network Diagram: Submit two copies, large enough to show entire network for entire construction period. Show logic ties for activities.

D. Contractor's Construction Schedule: Submit two copies of initial schedule, large enough to show entire schedule for entire construction period.

E. CPM Reports: Concurrent with CPM schedule, submit two copies of each of the following computer-generated reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
   1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
   2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.

3. Total Float Report: List of all activities sorted in ascending order of total float.
4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.

F. Field Condition Reports: Submit two copies at time of discovery of differing conditions.

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

1.5 COORDINATION

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

B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
1. Secure time commitments for performing critical elements of the Work from parties involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
2. Initial Submittal: Submit concurrently with preliminary network diagram. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.
4. The Owner will review the schedule of submittals and identify the submittals that they want to receive a copy of at the same time that the Architect’s copies are sent out.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."

B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.
1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
   1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
   2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
   3. Submittal Review Time: Include review and resubmittal times indicated in Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
   4. Startup and Testing Time: Include times for startup and testing.
   5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
   1. Phasing: Arrange list of activities on schedule by phase.
   2. Work under More Than One Contract: Include a separate activity for each contract.
   3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
   4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 1 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
   5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 1 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
   6. Work Restrictions: Show the effect of the following items on the schedule:
      a. Coordination with existing construction.
      b. Limitations of continued occupancies.
      c. Uninterruptible services.
      d. Partial occupancy before Substantial Completion.
      e. Use of premises restrictions.
      f. Provisions for future construction.
      g. Seasonal variations.
      h. Environmental control.
      i. Restriction of noise making operations during final exam weeks.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Mechanical Commissioning, Substantial Completion, and Final Completion.

F. Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.
   1. Refer to Division 1 Section "Payment Procedures" for cost reporting and payment procedures.
   2. Contractor shall assign cost to construction activities on the CPM schedule. Costs shall not be assigned to submittal activities unless specified otherwise but may, with Architect's approval, be assigned to fabrication and delivery activities. Costs shall be under required principal subcontracts for testing and commissioning activities, operation

and maintenance manuals, punch list activities, Project Record Documents, and demonstration and training.

3. Each activity cost shall reflect an accurate value subject to approval by Architect.
4. Total cost assigned to activities shall equal the total Contract Sum.

G. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragments to demonstrate the effect of the proposed change on the overall project schedule.

H. Computer Software: Prepare schedules using a program that has been developed specifically to manage construction schedules.

2.3 BROAD SCOPE MILESTONE SCHEDULE

A. Submit a separate general broad scope schedule to provide a basic progress report for the Owner's use. Examples of broad scope line items to include are: Site Work, Cast-In-Place Concrete, Framing, Rough MEP, Building Envelope, Interior Finishes, Exterior Finishes, Final MEP, Commissioning, 2 Week IAQ Flush Out, Certificate of Occupancy. Update schedule on a monthly basis for submission at project meetings.

2.4 REPORTS

A. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

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

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

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

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

B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
   1. Post copies in Project meeting rooms and temporary field offices.
   2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Sections include the following:
   1. Division 01 Section "Payment Procedures" for submitting Applications for Payment and the Schedule of Values.
   2. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
   3. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.
   4. Division 01 Section "Quality Requirements" for submitting test and inspection reports and for mockup requirements.
   5. Division 01 Section "Closeout Procedures" for submitting warranties.
   6. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
   7. Divisions 02 through 33 Sections for specific requirements for submittals in those Sections.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect's responsive action.

B. Informational Submittals: Written information that does not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
      a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

B. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

C. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
   1. Initial Review: Allow 15 days minimum for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
   2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
   3. Resubmittal Review: Allow 15 days minimum for review of each resubmittal.
   4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days minimum for initial review of each submittal.

D. Electronic Submittals: Architect is using Newforma software to process electronic submittals. Identify and incorporate information in each electronic submittal file as follows:
   1. Assemble complete submittal package into single files incorporating submittal requirements of a single Specification Section and transmittal form.
      a. Provide a separate transmittal form for Product Data, a separate transmittal form for Shop Drawings, and a separate transmittal form for Informational Submittals required by each Specification Section.
      b. Maximum File Size: A single file size, up to 18MB can be received. Contact Architect for instructions if file exceeds 18MB.
      c. For each transmittal, attach one single PDF only. Where multiple PDFs are required for a transmittal, utilize Adobe Acrobat combine feature to merge the PDFs into a single PDF.
         1) Unacceptable Formats: In order to process the transmittals in Newforma, the single PDF file protocol must be followed. Transmittals zip files or grouped PDFs cannot be electronically processed and will be returned without action for correction and resubmittal.
         2) Submittals will be returned without action for correction and resubmittal if:
            a) Submittal does not have an electronic Transmittal Form.
            b) Multiple specification sections are contained within a single Transmittal form. Submittals must be separated into individual Specification Sections.
   2. Name file with submittal number or other unique identifier, including revision identifier.
      a. File name shall use project identifier and Specification Section number followed by a dash and then a sequential number (e.g., LNHS-061000-01). Resubmittals shall include an alphabetic suffix after another dash (e.g., LNHS-061000-01-A).
   3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
   4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner, containing the following information:
      a. Project name.
      b. Date.
      c. Name and address of Architect.
      d. Name of Construction Manager.
      e. Name of Contractor.
      f. Name of firm or entity that prepared submittal.
      g. Names of subcontractor, manufacturer, and supplier.
      h. Category and type of submittal.
      i. Submittal purpose and description.

j. Specification Section number and title.
k. Specification paragraph number or drawing designation and generic name for each of multiple items.
l. Drawing number and detail references, as appropriate.
m. Location(s) where product is to be installed, as appropriate.
n. Related physical samples submitted directly.
o. Indication of full or partial submittal.
p. Transmittal number.
q. Submittal and transmittal distribution record.
r. Other necessary identification.
s. Remarks.

E. Options: Identify options requiring selection by Architect.

F. Deviations: Encircle or otherwise specifically identify deviations from the Contract Documents on submittals.

G. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
1. Additional copies submitted for maintenance manuals will be marked with action taken and will be returned.
2. Send one additional copy of the submittals identified in the Owner's mark-up of the schedule of submittals directly to the Owner at the same time that the Architect's copies are sent out.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are approved.

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

J. Use for Construction: Use only final submittals with mark indicating approval taken by Architect.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Submit electronic submittals by either of the following methods:
a. Via email as PDF electronic file to **submittals@harriman.com** .
1) Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2. Post electronic submittals as PDF electronic files directly to Architect's FTP site specifically established for Project.
    a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
3. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
4. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
    a. Manufacturer's written recommendations.
    b. Manufacturer's product specifications.
    c. Manufacturer's installation instructions.
    d. Standard color charts.
    e. Manufacturer's catalog cuts.
    f. Wiring diagrams showing factory-installed wiring.
    g. Printed performance curves.
    h. Operational range diagrams.
    i. Mill reports.
    j. Standard product operation and maintenance manuals.
    k. Compliance with specified referenced standards.
    l. Testing by recognized testing agency.
    m. Application of testing agency labels and seals.
    n. Notation of coordination requirements.
4. Submit Product Data before or concurrent with Samples.
5. Number of Copies: Submit three copies of Product Data, unless otherwise indicated. Architect will return one copy for reproduction and distribution. Mark up and retain one returned copy as a Project Record Document.
    a. Send one additional copy of the submittals identified in the Owner’s mark-up of the schedule of submittals directly to the Owner at the same time that the Architect’s copies are sent out.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    a. Dimensions.
    b. Identification of products.
    c. Fabrication and installation drawings.
    d. Roughing-in and setting diagrams.
    e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
    f. Shopwork manufacturing instructions.
    g. Templates and patterns.
    h. Schedules.

i. Design calculations.
j. Compliance with specified standards.
k. Notation of coordination requirements.
l. Notation of dimensions established by field measurement.
m. Relationship to adjoining construction clearly indicated.
n. Seal and signature of professional engineer if specified.
o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 40 inches.
3. Number of Copies: Submit three opaque copies of each submittal. Architect will retain two copies; Architect will return one copy for reproduction and distribution. Mark up and retain one returned copy as a Project Record Drawing and copies where copies are required for operation and maintenance manuals.
   a. Send one additional copy of the submittals identified in the Owner's mark-up of the schedule of submittals directly to the Owner at the same time that the Architect's copies are sent out.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:
   a. Generic description of Sample.
   b. Product name and name of manufacturer.
   c. Sample source.
   d. Number and title of appropriate Specification Section.
3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
   a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
   b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
   a. Number of Samples: Submit two full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
   a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.

1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
3) Send one additional sample(s) of the submittals identified in the Owner's mark-up of the schedule of submittals directly to the Owner at the same time that the Architect's copies are sent out.

E. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product.
2. Number and name of room or space.
3. Location within room or space.
4. Number of Copies: Submit three copies of product schedule or list, unless otherwise indicated. Architect will return one copy for reproduction and distribution.
a. Mark up and retain one returned copy as a Project Record Document.

F. Contractor's Construction Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation."

G. Submittals Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation."

H. Application for Payment and Schedule of Values: Comply with requirements specified in Division 1 Section "Payment Procedures."

I. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.
4. Number of Copies: Submit three copies of subcontractor list, unless otherwise indicated. Architect will return one copy.
a. Mark up and retain one returned copy as a Project Record Document.

J. Coordination Drawings: Comply with requirements specified in Division 1 Section "Project Management and Coordination."

K. Contractor's Construction Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation."

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

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

N. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

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

P. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

Q. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

R. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

S. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

T. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
   1. Name of evaluation organization.
   2. Date of evaluation.
   3. Time period when report is in effect.
   4. Product and manufacturers' names.
   5. Description of product.
   6. Test procedures and results.
   7. Limitations of use.

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

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

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

X. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment.

Y. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

Z. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

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

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

CC. Material Safety Data Sheets (MSDSs): Submit information directly to Owner at end of the project; do not submit to Architect. Maintain copy at the site for the duration of the construction.
1. Architect will not review submittals that include MSDSs and will return them.

2.2 DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

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

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
   1. The Contractor shall review submittals for completeness and compliance with the Contract Documents. If submittal contains substitutions, Contractor shall process substitutions in accordance with Division 1 Section "Substitutions and Product Options," and not part of specified Shop Drawings or Product Data submittals. Contractor is responsible for keeping Subcontractors on time with the submittal schedule. If the Contractor submits submittals that are repeatedly rejected, requiring the Architect to perform multiple reviews of the same submittal because of the failure to properly prepare and complete the submittals:
      a. Owner will compensate Architect for such additional services.
      b. Owner will deduct the amount of such compensation from the final payment to the Contractor.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

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

B. Owner's Review: The Owner will convey comments regarding select submittals identified in the Owner's mark-up of the schedule of submittals to the Architect.

C. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.

D. The Architect's marking of "Approved," Approved as Noted" or similar verbiage means submittal has been reviewed for general conformance to the contract documents only and does not mean unqualified acceptance. The Contractor is fully responsible for compliance with the contract documents.

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

F. Partial submittals are not acceptable, will be considered non-responsive, and will be returned without review.

G. Submittals not required by the Contract Documents may not be reviewed and will be discarded.

END OF SECTION 013300

AGREEMENT BETWEEN ARCHITECT OF RECORD AND OWNER OR CONTRACTOR FOR TRANSFER OF COMPUTER AIDED DRAFTING (CAD) FILES ON ELECTRONIC MEDIA

Architect of Record (Architect):
Harriman
Auburn Business Park
46 Harriman Drive
Auburn, ME 04210

Recipient:

Project No. _____ Date: _____

Project Name: _____
Location: _____

The Architect will provide the following CAD files, dated _____ for the project use by the Recipient:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

Drawings were prepared on the following:
Computer Hardware: PC Operating System: Windows 7 64 bit
Software: (Arris 8) or (Microstation V8i) or Autocad 2011 or (Revit 12, 13)

Converted to: (Autocad 2004 thru 2013) (DWG)

Recipient shall pay Architect a handling fee of $100. A translation fee of $25 for each drawing will also apply (if applicable). This signed agreement and payment of fees are required prior to transferring the files.

Handling fee: $100.00 + $5.50 Maine State Sales Tax (5.5%)= $105.50
Translation fee: number of drawings _____ (x $25) _____+ Maine State Sales Tax (5.5%) = _____
Total Cost: = _____

Transfer method (check one):

_____ E-mail, provide email address: _____
_____ Electronic File Transfer (FTP) provide email address: _____
_____ CD-ROM
_____ USB Flash Drive

Payment type (check one):

_____ Check
_____ Credit Card (Visa or Master Card only)
_____Visa_____Master Card
Name of Cardholder: _____
Credit card no: _____ _____ _____ _____ Exp. Date____
Address: _____ Sec. Code _____
_____
_____ _____

TERMS AND CONDITIONS:

1. It is understood and agreed that all drawings, specifications, or other documents of any kind prepared by Architect or its subconsultants, whether in hard copy or in electronic or machine readable format including Electronic Documents (collectively the "Architect's Documents"), are instruments of their services prepared solely for use in connection with the single project for which they were prepared and that Architect and its

subconsultants retain all common law, statutory and other reserved rights, including the copyright. This agreement is not intended in any way to alter the respective interests of the parties in the Instruments of Service as set forth in the Owner/Architect Agreement, notwithstanding Architect's agreement to release the Electronic Documents to Recipient.

2. The Electronic Documents 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 Documents do not replace or supplement the paper copies of the Drawings and Specifications, which are, and remain, the Contract Documents for the Project. In all instances, it is the responsibility of the Recipient to insure that the Electronic Documents are consistent with the Contract Documents.

3. The parties agree that the Electronic Documents are not, nor shall they be construed to be, a product. It is expressly agreed by the Recipient that there are no warranties of any kind in such Electronic Documents or in the media in which they are contained, either express or implied.

4. Architect makes no representation as to the compatibility of the CAD files with any hardware or software.

5. Since the information set forth on the CAD files can be modified unintentionally or otherwise, the Architect reserves the right to remove all indicia of its ownership and/or involvement from each electronic display.

6. If any differences exist between printed Instruments of Service and Electronic Documents, the information contained in the printed documents shall be presumed to be correct and take precedence over the Electronic Documents.

7. Recipient agrees not to add to, modify or alter in any way, or to allow others to add to, modify or alter in any way, the Electronic Documents or any printed copies thereof.

8. The Electronic Documents are supplied in a translatable format. Any conversion of the format is solely the responsibility of the Recipient. Recipient understands and agrees that the conversion of hard copies of Instruments of Service into electronic or machine readable format or the conversion of Electronic Documents from the machine readable formats used by Architect to some other format may introduce errors or other inaccuracies. Recipient agrees to accept all responsibility for any errors or inaccuracies and to release Architect, and its subconsultants from any liability or claims for recovery of damages or expenses arising as the result of such errors or inaccuracies.

9. Where the Recipient has received specific permission to use the Electronic Documents in connection with the Recipient's obligation to prepare certain documents for Project, Recipient shall, in addition to the other obligations set forth therein, be obligated to remove Architect's or Architect's Consultant's title block from the copy of the Electronic Documents used by Recipient. It is understood and agreed that, without the separate express written permission of the Architect to do so, the Electronic Documents are not to be used by any contractor or any of its subcontractors of any tier of material supplier or vendor as a shop drawing or any other type of submittal or as the basis for preparing such shop drawing or submittal. The sole exception to this prohibition shall be that the Recipient may use the Electronic Documents as a clearly distinguishable separate background upon which to prepare its shop drawings or other submittal.

10. Recipient further agrees that the Architect's Documents were prepared for use in connection with this project only and that the Electronic Documents are supplied to Recipient for the limited use stated above only. Recipient agrees not to use, or to allow others to use, the Electronic Documents, in whole or in part, for any purpose other than as stated above.

11. The Architect believes that no licensing or copyright fees are due to others on account of the transfer of the CAD files, but to the extent any are, the Contractor will pay the appropriate fees and hold the Architect harmless from such claims.

12. Any purchase order number provided by the Contractor is for Contractor's accounting purposes only. Purchase order terms and conditions are void and are not a part of this agreement.

13. Harriman has prepared these Cad files for the sole purpose of plotting and printing a hard copy of the design documents. Harriman believes only the hard copy print to be the accurate representation of all drawing information. Hard copy written dimensions override electronic measured dimensions. User must verify computer data against hard copy prints.

14. Electronic Cad files are an inherently unstable medium and subject to "bugs," deterioration, modifications, and viruses. Cad files are subject to inadvertent changes in the process of moving from one computer to another; or by compressing and decompressing the data; or by moving from one software revision to another; or any kind of manipulation of the data will lead to defects.

15. This agreement shall be governed by the laws of the principal place of business of the Architect. Only printed copies of the Instrument of Service shall be signed and sealed.

16. Recipient agrees to waive any and all claims and liability against Architect and its subconsultants resulting in any way from any failure by Recipient to comply with the requirements of this Agreement for the Delivery of Documents in Electronic Format.

17. The Recipient agrees that no third party beneficiary status or any other right of action is created in favor of any contractor, subcontractor, materialmen or other third party against the Architect by virtue of this Agreement or in connection with its delivery of Electronic Documents, and no third party beneficiary status is intended.

18. Recipient further agrees to indemnify and save harmless the Architect and its subconsultants and each of their partners, officers, shareholders, and directors and employees from any and all claims, judgments, suits, liabilities, damages, costs or expenses (including reasonable defense and attorneys fees including claims asserted in breach of contract, breach of warranty, negligence, or any other tort) arising as a result of either: 1) Recipient's failure to comply with any of the requirements of Agreement for the Delivery of Documents in Electric Format; or 2) a defect, error or omission in the Electronic Documents or the information contained therein, which defect, error or omission was not contained in the Contract Documents as defined in Paragraph 2 or where the use of such Contract Documents would have prevented the claim, judgment, suit, liability, damage, cost, or expense.

19. Architect reserves the right to deny a request to translate files.

AUTHORIZED ACCEPTANCE

by Architect of Record (Architect)	by Recipient
_____	_____
Signature	Signature (by officer)*
_____	_____
Print Name and Title	Print Name and Title
_____	_____
Date	Date
	Witness: _____

*NOTE: Original signature required, do not FAX.

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SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
   3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
   4. The Owner will hire an independent firm to do the testing and balancing of the air system and to do mechanical commissioning.

C. Related Sections include the following:
   1. Division 01 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.
   2. Division 01 Section "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting activities.
   3. Divisions 02 through 33 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

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

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples.

D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.

E. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

F. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

G. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

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

I. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
   1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

K. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

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

1.5 SUBMITTALS

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

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Description of test and inspection.
   3. Identification of applicable standards.
   4. Identification of test and inspection methods.
   5. Number of tests and inspections required.
   6. Time schedule or time span for tests and inspections.
   7. Entity responsible for performing tests and inspections.
   8. Requirements for obtaining samples.
   9. Unique characteristics of each quality-control service.

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

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

1.6 QUALITY ASSURANCE

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

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

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

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

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

F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
   1. Requirement for specialists shall not supersede building codes and regulations governing the Work.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
   1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
   2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

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

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

J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
   2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
   3. Demonstrate the proposed range of aesthetic effects and workmanship.
   4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
      a. Allow seven days for initial review and each re-review of each mockup.
   5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   6. Demolish and remove mockups when directed, unless otherwise indicated.

K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Sections in Divisions 2 through 16.

1.7 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
   1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
   2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
   3. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
   1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
      a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
   2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
   3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
   4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
   5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 1 Section "Submittal Procedures."

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

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

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
   1. Access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.
   3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
   4. Facilities for storage and field curing of test samples.
   5. Delivery of samples to testing agencies.
   6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
   7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
   1. Schedule times for tests, inspections, obtaining samples, and similar activities.

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for commencement of the Work.
   1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.8 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, in compliance with applicable building code.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:
   1. Date test or inspection was conducted.
   2. Description of the Work tested or inspected.
   3. Date test or inspection results were transmitted to Architect.
   4. Identification of testing agency or special inspector conducting test or inspection.

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

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Comply with the Contract Document requirements for Division 1 Section "Cutting and Patching."

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

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

END OF SECTION 014000

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SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Temporary utilities include, but are not limited to, the following:
1. Sanitary facilities, including toilet facilities.
2. Heating facilities.
3. Ventilation.
4. Electric power service.
5. Lighting.
6. Telephone service.
7. Internet service.

C. Support facilities include, but are not limited to, the following:
1. Waste disposal facilities.
2. Lifts and hoists.
3. Construction aids and miscellaneous services and facilities.

D. Security and protection facilities include, but are not limited to, the following:
1. Tree and plant protection.
2. Security enclosure and lockup.
3. Barricades, warning signs, and lights.
4. Dust protection.
5. Fire protection.

E. Related Sections include the following:
1. Division 01 Section "Execution Requirements" for progress cleaning requirements.
2. Divisions 02 through 33 for temporary heat, ventilation, and humidity requirements for products in those Sections.

1.3 USE CHARGES

A. Electric Power Service, Water Service: The use of existing power and water will be allowed for the Work without charge at the existing building.

1.4 QUALITY ASSURANCE

A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.
1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.

B. The Contractor is responsible for the implementation, monitoring, and maintenance of job site safety program for the duration of the contract.

1.5 PROJECT CONDITIONS

A. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
   1. Keep temporary services and facilities clean and neat.
   2. Relocate temporary services and facilities as required by progress of the Work.

B. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site. Construction noise from loud machinery, equipment, hammering and similar loud noises shall be restricted to the hours of when the facility is not in use. Obey State and local noise ordinances.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. General: Provide equipment suitable for use intended.

B. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.
   1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

C. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
   1. Coordinate with the Architect and Owner at the preconstruction meeting.

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

3.2 TEMPORARY UTILITY INSTALLATION

A. Water Service: Obtain water required for the work from location designated by the Owner.

B. Sanitary Facilities:
   1. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Use of Owner’s existing toilet facilities will not be permitted.

C. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

D. Temporary Electric Power Service:
   1. Provide grounded electric power distribution of sufficient size, capacity, and power characteristics during construction period, connecting to existing campus power service at location designated by owner.

E. Telephone Service: Provide cellular telephone service with voice mail throughout construction period.

F. Internet Service: Provide laptop computer at the site. Internet connection is available at the college campus. Coordinate with Owner for connection to the college service. Limit use of service to authorized personnel only, for specific project business only.

3.3 SUPPORT FACILITIES INSTALLATION

A. Project Identification and Temporary Signs: Prepare Project identification signs. Install signs to inform public and persons seeking entrance to Project. Do not permit installation of unauthorized signs.
   1. Prepare temporary signs to provide directional information to construction personnel and visitors.

B. Waste Disposal Facilities: Provide waste-collection dumpsters and containers in sizes adequate to handle waste from construction and demolition operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste. Comply with Division 01 Section "Execution Requirements" for progress cleaning requirements.
   1. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited.
   2. Develop a waste management plan for Work performed on Project. Indicate types of waste materials Project will produce and estimate quantities of each type. Provide detailed information for on-site waste storage and separation of recyclable materials. Provide information on destination of each type of waste material and means to be used to dispose of all waste materials.

C. Contractor Field Office and Storage Sheds: If Contractor requires a field office trailer and storage trailers, coordinate available location on campus with the Owner.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.

B. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of the building and exterior openings. Provide temporary enclosures to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

C. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.

D. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior. Provide temporary enclosures to prevent unauthorized entry into the building through exterior openings.
   1. Building shall remain protected and watertight. Water damage shall be corrected by the Contractor at no cost to the Owner.

E. Temporary Dust Partitions:
   1. Provide temporary dust partitions isolating the work from occupied spaces before starting any new work. Obtain approval from Architect and Owner before removal of partitions.
   2. All Temporary dust partitions in place less than 3 days may be Cirvico fire-retardant vinyl and adequately supported sealed with duct tape.

F. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
   1. Provide fire extinguishers, visible and accessible from space being served.
   2. Store combustible materials in containers in fire-safe locations.
   3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
   4. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition. Provide fire watchman for cutting and welding operations.
   5. Develop and supervise an overall fire-prevention and first-aid fire-protection program for personnel at Project site. Instruct personnel in methods and procedures. Post warnings and information.

3.5 OPERATION, TERMINATION, AND REMOVAL

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

B. Maintenance: Maintain facilities in good operating condition. Protect from damage caused by natural elements.
   1. Maintain operation of temporary enclosures, heating, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

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

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

1. Materials and facilities that constitute temporary facilities are the property of Contractor.
2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division 01 Section "Closeout Procedures."

END OF SECTION 015000

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SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

B. Related Sections include the following:
   1. Division 01 Section “Substitutions and Product Options” for procedures and requirements for product substitutions.
   2. Division 01 Section "Closeout Procedures" for submitting warranties for Contract closeout.
   3. Divisions 02 through 33 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

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

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

1.4 SUBMITTALS

A. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

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

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

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

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

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
   2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

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

C. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
   4. Where products are accompanied by the term "as selected," Architect will make selection.
   5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
   6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
   7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.

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

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 016300 - SUBSTITUTIONS AND PRODUCT OPTIONS

PART 1 GENERAL

1.1 DESCRIPTION

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

1.2 SUBSTITUTIONS

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

B. In Making Request for Substitution, the Contractor Represents:
   1. Contractor has investigated proposed product or method and determined that it is equal or superior in all respects to that specified.
   2. Contractor will provide the same or greater guarantee for substitution as for product specified.
   3. Contractor will coordinate installation of accepted substitution into work, making such changes as required for work to be completed.
   4. Contractor waives all claims for additional costs related to substitution in which it becomes apparent before, during or after installation.
   5. Requested substitution is compatible with other portions of the Work. All sizes, dimensions, locations for connections to other items as designed, clearances from building structure and other equipment have been verified and is acknowledged in the substitution request
   6. Contractor requesting substitution shall bear additional costs to all parties due to his substitution, including Architect's fees.

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

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

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION 016300

SUBSTITUTION REQUEST FORM

Project: _____ Substitution Request Number:_____
To: _____ From: _____
Re: _____ Date: _____
Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____Address: _____ Phone: _____
Trade Name: _____Model No. _____
Attached data includes product description, specifications, drawings, cost data, and performance and test data adequate for evaluation of the request: applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitutions will require for its proper installation.

Attached data includes a detailed itemized comparison list of product substitution with product specified.

The Undersigned certifies:

1. Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified product.
2. Will provide the same 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. All sizes, dimensions, locations for connections to other items as designed, clearances from building structure and other equipment have been verified.
4. Will remove substitution and pay all costs if differences discovered later that were not identified on the substitution request are found that make the substitution unacceptable with no additional cost to Owner.
5. Waive claims for additional costs or time extension that may subsequently become apparent.
6. Will reimburse Owner and Architect/Engineer for review or redesign services associated with substitution.
7. They are authorized to sign this form for the product manufacturer, and commit to the terms of Section ASubstitutions and Product Options,@ and this substitution request form.

Submitted By: _____

Signed By: _____

Firm: _____

Address: _____

Telephone: _____ Fax: _____

A/E's REVIEW AND ACTION

☐ Submission approved - Make submittals in accordance with Specification Section 013300.
☐ Submission approved as noted - Make submittals in accordance with Specification Section 013300.
☐ Submission rejected - Use specified materials.
☐ Submission request received too late - Use specified materials.

Signed by: _____ Date: _____

Supporting Data Attached:

☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports
☐ Comparison list ☐ Other

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SECTION 017300 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
   1. General installation of products.
   2. Coordination of Owner-installed products.
   3. Progress cleaning.
   4. Starting and adjusting.
   5. Protection of installed construction.
   6. Correction of the Work.

B. Related Sections include the following:
   1. Division 01 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
   2. Division 01 Section "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
   3. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.

B. Existing Systems: The existence and location of utilities and construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of utilities and other construction affecting the Work.

C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
   a. Description of the Work.
   b. List of detrimental conditions, including substrates.
   c. List of unacceptable installation tolerances.
   d. Recommended corrections.
2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.3 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Verification: Before proceeding to layout the Work, verify layout information shown on Drawings. If discrepancies are discovered, notify Architect promptly.
2. Make vertical work plumb and make horizontal work level.
3. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
4. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
5. Maintain minimum headroom clearance of 8 feet in spaces without a suspended ceiling, unless indicated otherwise.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
   2. Allow for building movement, including thermal expansion and contraction.
   3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.
   1. No asbestos containing materials shall be used in the work.

3.4 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction forces.

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

3.5 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
   1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
   2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F.
   3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work. It is the Contactor's responsibility for job site safety.
   1. Remove liquid spills promptly.
   2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
      a. Clean interior spaces prior to the start of finish painting, and continue cleaning on an as-needed basis until painting is finished.
      b. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly coated surfaces.
   3. Remove materials and debris that create tripping hazards.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.6 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

E. Comply with Division 01 Section “Integrated Deliverables and Testing (IDAT)” requirements.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.8 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."
   1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

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SECTION 017329 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes procedural requirements for cutting and patching.
   1. For correction of installed work.
   2. For repairs due to testing.

B. Related Sections include the following:
   1. Division 02 Section "Selective Demolition and Alterations" for demolition of selected portions of the building and additional patching requirements.
   2. Divisions 02 through 33 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
   1. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
   2. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.5 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include the following:
   1. Primary operational systems and equipment.
   2. Air or smoke barriers.
   3. Fire-suppression systems.
   4. Mechanical systems piping and ducts.
   5. Control systems.
   6. Communication systems.
   7. Conveying systems.
   8. Electrical wiring systems.

C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include the following:
   1. Water, moisture, or vapor barriers.
   2. Membranes and flashings.
   3. Equipment supports.
   4. Piping, ductwork, vessels, and equipment.
   5. Noise and vibration-control elements and systems.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.6 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
   1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
   1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
   2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
   5. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
   2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
      a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
      b. Restore damaged pipe covering to its original condition.
   3. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 017329

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Salvaging nonhazardous demolition and construction waste.
   2. Recycling nonhazardous demolition and construction waste.
   3. Disposing of nonhazardous demolition and construction waste.
   4. Recycling of DEP-Regulated Universal waste.

B. Related Requirements:
   1. Section 024119 "Selective Demolition and Alterations" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.
   2. Refer to drawings for additional information.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Reused or Salvaged: Recovery of demolition or construction waste and subsequent sale, donation, or reuse in another facility or incorporated into the Work.

F. Universal Waste: Any waste designated by the Maine Department of Environmental Protection as Universal Waste i.e. fluorescent lamps, ballasts, thermostats and other lead and mercury containing devices. Information can be found on the DEP's website: http://www.maine.gov/dep/index.html

G. USM Waste Minimization Policy: This policy and additional Information on recycling and waste can be found on the USM Recycling Website: http://www.usm.maine.edu/sustainability/recycling

1.4 PERFORMANCE REQUIREMENTS

A. General: Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators by sorting prior to leaving the jobsite. Facilitate recycling and salvage of materials. All waste must be disposed of at facilities that operate in accordance with all local, state, and federal waste regulations. Documentation of compliance can be requested by the University of Southern Maine at any time.

1.5 SUBMITTALS

A. Submit 'Anticipated Project Waste Sheet' before commencement of work.

B. Submit 'Waste Reporting Sheet' monthly with each Pay Requisition during the course of the project and prior to Final Requisition.
   1. Include the following information on Waste Reporting Sheet:
      a. Date of disposal
      b. Type of material(s)
      c. Method(s) of disposal: recycled, reused/salvaged, landfilled, incinerated.
      d. Weight(s): attach copies of scale tickets to form (see below)

C. Copies of scale tickets from waste facilities, including transfer and processing facilities, for each haul must be attached to monthly 'Project Waste Sheet' on which the waste is listed.

D. Copies of Certificates of Recycling from DEP-approved consolidators for all hauls over the course of the project which involved Universal Waste must be attached to final Waste Reporting Sheet at conclusion of project.

E. Copy of Certificate of Refrigerant Recovery must be attached to Waste Reporting Sheet on which device is listed. Refrigerant Recovery must be performed by an EPA-approved Refrigerant Recovery Technician.

1.6 QUALITY ASSURANCE

A. Contractors must designate someone in their employ (a direct paid employee of the general contractor) to be the contact for waste reporting for the duration of the project.

B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
   1. For any questions or clarifications of waste handling procedures contact the USM project manager directly.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 RECYCLING / SALVAGING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers in accordance with USM Waste Minimization policy.

B. Preparation of Waste: Prepare and maintain recyclable and salvageable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling or reusing process.

C. Procedures: Separate recyclable and salvageable waste from other waste materials, trash, and debris. Sort recyclable waste by type at Project site to the maximum extent practical.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
2. Inspect containers and bins for contamination and remove contaminated materials if found.

3.2 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged/reused or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

END OF SECTION 017419

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Anticipated Project Waste Sheet

Building, Campus:_____ _____ Project Description:_____

Company Name:_____ Project Number:_____

Designated Contact:_____ Phone: _____ Date: _____

List types of waste materials anticipated throughout the duration of the project. Include demolition waste, bulky waste, product packaging, and anything generated that will need to be disposed of. Complete a second sheet if additional space is necessary. Include estimates of quantities, if able. In the second column describe proposed method of disposal, if known. In the third column estimate when the waste will be generated over the duration of the project.

Waste Materials / Quantities	Method of Disposal	Week # / Date

Questions: contact Steve Sweeney, Resource Recovery Supervisor, USM Facilities Management: (207) 780-4160

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Waste Reporting Sheet

Building, Campus:_____ Description of Project:_____

Company Name:_____ Project Number:_____

Designated Contact:_____ Phone: _____ Date: _____

This form must be filled out and submitted monthly with each Pay Requisition throughout the duration of the project and once prior to Final Requisition. Attach all scale tickets for items listed on the form.

Disposal: Recycled, Reused, Salvaged, Donated, Incinerated, Landfilled. Include packaging material.

Project waste generated:

Date	Material	Weight	Disposal/ Destination

Questions: contact Steve Sweeney, Resource Recovery Supervisor, USM Facilities Management: (207) 780-4160

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SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Inspection procedures.
   2. Warranties.
   3. Final cleaning.

B. Related Sections include the following:
   1. Division 01 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
   2. Division 01 Section "Execution Requirements" for progress cleaning of Project site.
   3. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
   4. Divisions 02 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
   1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
   2. Advise Owner of pending insurance changeover requirements.
   3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
   4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   5. Prepare and submit Project Record Documents, operation and maintenance manuals.
   6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
   7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
   8. Complete startup testing of systems.
   9. Submit test/adjust/balance records.
   10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
   11. Advise Owner of changeover in heat and other utilities.
   12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
   13. Complete final cleaning requirements, including touchup painting.

14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
15. Submit initial draft copy of operation and maintenance manuals at least 15 days before requesting inspection for Substantial Completion.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 INSPECTION FEES

A. If the Architect Performs Reinspections Due to Failure of the Work to Comply with the Claims of Status of Completion Made by the Contractor, Or, Should the Contractor fail to complete the work, Or, Should the Contractor fail to promptly correct warranty items or work later found to be deficient:
1. Owner will compensate Architect for such additional services.
2. Owner will deduct the amount of such compensation from the final payment to the Contractor.

B. If the Work is not completed by the date set in the Agreement, and the Architect needs to perform additional Contract Administrative and on site observation duties:
1. Owner will compensate Architect for such additional services.
2. Owner will deduct the amount of such compensation from the final payment to the Contractor.

1.6 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
   1. Organize list of spaces in sequential order.
   2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
   3. Include the following information at the top of each page:
      a. Project name.
      b. Date.
      c. Name of Architect.
      d. Name of Contractor.
      e. Page number.

1.7 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated in the contract documents.
   1. Unless indicated otherwise, all warranties shall commence on the date of Substantial Completion.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
   1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
j. Resilient flooring shall be scrubbed and cleaned with cleaner recommended by the flooring manufacturer just prior to occupation by Owner. No-wax floors shall buffed in accordance with flooring manufacturer's requirements.
k. Floors to receive wax shall be waxed just prior to occupation by Owner. Waxing shall consist of three coats, properly buffed to a uniform sheen. Work shall be done by a floor care subcontractor. Coordinate selection of wax with flooring manufacturer and Owner's maintenance program.
l. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
m. Remove labels that are not permanent.
n. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
o. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
p. Replace parts subject to unusual operating conditions.
q. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
r. Replace disposable air filters and clean permanent air filters that are exposed to the work. Clean exposed surfaces of diffusers, registers, and grills.
s. Clean ducts, blowers, and coils if units were operated without filters during construction.
t. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
u. Leave Project clean and ready for occupancy.

C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 017700

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SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory.
   2. Operation manuals for systems, subsystems, and equipment.
   3. Maintenance manuals for the care and maintenance of products, materials, and finishes, systems and equipment.

B. Related Sections include the following:
   1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
   2. Division 01 Section "Closeout Procedures" for submitting operation and maintenance manuals.
   3. Division 01 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
   4. Divisions 02 through 33 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.03 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.04 SUBMITTALS

A. Initial Submittal: Submit 2 draft copies of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Architect will review concurrently with Owner for comment. Architect will return copy of draft and mark whether general scope and content of manual are acceptable.

B. Final Submittal: Submit 2 copies of each manual in final form at least 15 days before final inspection. Architect will review concurrently with Owner for comment. Architect will return copy with comments after final inspection.
   1. Correct or modify each manual to comply with comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments.

C. Preliminary Operation and Maintenance Manual Summary: Submit two copies concurrently with the submittal of the Schedule of Values in accordance with Division 01 section, "Submittal Procedures."

1.05 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.01 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:
1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.02 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name, address, and telephone number of Contractor and primary subcontractors.

6. Name and address of Architect.
7. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
   1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
   1. Binders: Heavy-duty, D-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents but not greater than 2 inches, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets. Do not over fill D-ring, allowing 1/2-inch space for future additions.
      a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
      b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
   2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
   3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
   4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
   5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
      a. Maximum size of drawings to be included in the binders shall not exceed 11-by-17-inch. Fold drawings to same size as text pages and use as foldouts.
      b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and submit envelopes with manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

E. Electronic Media: Submit one copy of each complete manual, including Record Shop Drawings and Product Data on CD-R in .PDF format. Bookmark based on the specifications table of contents and manual dividers.

F. Follow ASHRAE Guideline 4 - 2008 in the preparation of operating and maintenance documentation.

2.03 OPERATION MANUALS

A. Content: Daily operations and management of systems and equipment. In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
   1. System, subsystem, and equipment descriptions.
   2. Performance and design criteria if Contractor is delegated design responsibility.
   3. Operating standards.
   4. Operating procedures.
   5. Operating logs.
   6. Wiring diagrams.
   7. Control diagrams.
   8. Piped system diagrams.
   9. Precautions against improper use.
   10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:
   1. Product name and model number.
   2. Manufacturer's name.
   3. Equipment identification with serial number of each component.
   4. Equipment function.
   5. Operating characteristics.
   6. Limiting conditions.
   7. Performance curves.
   8. Engineering data and tests.
   9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:
   1. Startup procedures.
   2. Equipment or system break-in procedures.
   3. Routine and normal operating instructions.
   4. Regulation and control procedures.
   5. Instructions on stopping.
   6. Normal shutdown instructions.
   7. Seasonal and weekend operating instructions.
   8. Required sequences for electric or electronic systems.
   9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.04 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:
   1. Product name and model number.
   2. Manufacturer's name.
   3. Color, pattern, and texture.
   4. Material and chemical composition.
   5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
   1. Inspection procedures.
   2. Types of cleaning agents to be used and methods of cleaning.
   3. List of cleaning agents and methods of cleaning detrimental to product.
   4. Schedule for routine cleaning and maintenance.
   5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

2.05 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
   1. Standard printed maintenance instructions and bulletins.
   2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   3. Identification and nomenclature of parts and components.
   4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
   1. Test and inspection instructions.
   2. Troubleshooting guide.
   3. Precautions against improper maintenance.

4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training videotape, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.01 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
   1. Do not use original Project Record Documents as part of operation and maintenance manuals.

G. Comply with Division 1 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

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SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.
   4. Record Shop Drawings.

B. Related Sections include the following:
   1. Division 01 Section "Closeout Procedures" for general closeout procedures.
   2. Divisions 02 through 33 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.3 SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit copies of Record Drawings as follows:
      a. Submit one set(s) of marked-up Record Prints

B. Record Specifications: Submit one hard copy and one copy on electronic media of Project's Specifications, including addenda and contract modifications.

C. Record Shop Drawings and Product Data: Submit one hard copy and one copy on electronic media of each Product Data submittal.
   1. Where Record Shop Drawings and Product Data is required as part of operation and maintenance manuals, submit marked-up Shop Drawings and Product Data as an insert in manual instead of submittal as Record Shop Drawings and Product Data. Insert typewritten pages indicating typewritten pages indicating drawing titles, descriptions of contents, and Record Shop Drawings and Product Data locations drawing locations that are part of operation and maintenance manuals.
   2. Electronic Media: In addition to paper copy, submit record copy of record Shop Drawings and Product Data specification on CD-R in .PDF format. Bookmark Product Data based on the table of contents.

D. Directories: Material supplier directory and subcontractor directory.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
   1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      b. Accurately record information in an understandable drawing technique.
      c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
   2. Content: Types of items requiring marking include, but are not limited to, the following:
      a. Dimensional changes to Drawings.
      b. Revisions to details shown on Drawings.
      c. Revisions to routing of piping and conduits.
      d. Actual equipment locations.
      e. Locations of concealed internal utilities.
      f. Changes made by Change Order or Construction Change Directive.
      g. Changes made following Architect's written orders.
      h. Details not on the original Contract Drawings.
      i. Field records for variable and concealed conditions.
      j. Record information on the Work that is shown only schematically.
   3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
   4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
   5. Mark important additional information that was either shown schematically or omitted from original Drawings.
   6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
   1. Record Prints: Organize Record Prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions, change orders and product options selected.
   3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.

4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.
6. Electronic Media: Submit record copy of record specification on CD-R in .PDF format. Bookmark based on the table of contents.

2.3 RECORD SHOP DRAWINGS AND PRODUCT DATA

A. Preparation: Mark Shop Drawings and Product Data to indicate the actual product installation where installation varies substantially from that indicated in Shop Drawings and Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.
4. Bind product data in heavy-duty, D-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents but not greater than 2 inches, and sized to receive 8-1/2 by 11 inch paper. Do not over fill D-ring, allowing 1/2 inch space for future additions.
5. Provide heavy paper dividers with plastic-covered tabs for each specification section with product data. Mark tab to identify the specification section. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
6. Identify each binder on the front and spine with the typed or printed title "PRODUCT DATA," Project name, and name of Contractor.
7. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
    a. Maximum size of drawings to be included in the binders shall not exceed 11 by 17 inch. Fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and submit envelopes with manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.
8. Electronic Media: Submit record copy of marked-up Shop Drawings and Product Data on CD-R in .PDF format. Bookmark based on the table of contents, and for each Shop Drawings and Product Data within each section. Where Record Shop Drawings and Product Data is required as part of operation and maintenance manuals, submit electronic media of marked-up Shop Drawings and Product Data as part of manual instead of submittal as Record Shop Drawings and Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Subcontractor Directory: Name, address and telephone number for all major subcontractors, organized by specification section.

C. Material Supplier Directory: Name, address and telephone number for major material suppliers, organized by specification section.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Demonstration of operation of systems, subsystems, and equipment.
   2. Training in operation and maintenance of systems, subsystems, and equipment.

B. Related Sections include the following:
   1. Division 01 Section "Project Management and Coordination" for requirements for preinstruction conferences.
   2. Divisions 02 through 33 Sections for specific requirements for demonstration and training for products in those Sections.

1.3 SUBMITTALS

A. Attendance Record: For each training session, submit list of participants.

1.4 QUALITY ASSURANCE

A. Demonstrator and Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 1 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate providing notification of dates, times, length of instruction time, and training content.

C. Coordinate content of training with content of approved operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program: Develop an instruction program that includes individual training for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:

1. Conveying systems, including elevators .
2. HVAC systems equipment.
3. Lighting equipment and controls.

B. Training Modules: Include instruction as applicable for the following:
   1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
      a. System, subsystem, and equipment descriptions.
      b. Performance and design criteria if Contractor is delegated design responsibility.
      c. Operating standards.
      d. Regulatory requirements.
      e. Equipment function.
      f. Operating characteristics.
      g. Limiting conditions.
      h. Performance curves.
   2. Documentation: Review the following items in detail:
      a. Operations and maintenance manuals.
      b. Project Record Documents.
      c. Warranties and bonds.
      d. Maintenance service agreements and similar continuing commitments.
   3. Emergencies: Include the following, as applicable:
      a. Instructions on meaning of warnings, trouble indications, and error messages.
      b. Instructions on stopping.
      c. Shutdown instructions for each type of emergency.
      d. Operating instructions for conditions outside of normal operating limits.
      e. Sequences for electric or electronic systems.
      f. Special operating instructions and procedures.
   4. Operations: Include the following, as applicable:
      a. Instructions on meaning of warnings, trouble indications, and error messages.
      b. Startup procedures.
      c. Equipment or system break-in procedures.
      d. Routine and normal operating instructions.
      e. Regulation and control procedures.
      f. Control sequences.
      g. Safety procedures.
      h. Instructions on stopping.
      i. Normal and emergency shutdown instructions.
      j. Operating procedures for system, subsystem, or equipment failure.
      k. Seasonal and weekend operating instructions.
      l. Required sequences for electric or electronic systems.
      m. Special operating instructions and procedures.
   5. Adjustments: Include the following:
      a. Alignments.
      b. Checking adjustments.
      c. Noise and vibration adjustments.
      d. Economy and efficiency adjustments.
   6. Troubleshooting: Include the following:
      a. Diagnostic instructions.
      b. Test and inspection procedures.
   7. Maintenance: Include the following:
      a. Inspection procedures.
      b. Types of cleaning agents to be used and methods of cleaning.

c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble materials necessary for instruction.

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
   1. Owner will furnish Contractor with names and positions of participants.

B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
   1. Schedule training with Owner with at least fifteen days' advance notice.

END OF SECTION 017900

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SECTION 019500 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 FOR INFORMATION ONLY

A. The testing, adjusting and balancing (TAB) Agent shall be contracted directly with the Owner. This Specification section has been included for information only, to inform the Contractor that testing, adjusting and balancing will be performed on the mechanical systems and that the Contractor is responsible for assisting and coordinating with the TAB Agency as described in this section.

1.2 SECTION INCLUDES

A. Testing, Adjustment, and Balancing of Air Systems.

B. Testing, Adjustment, and Balancing of Hydronic Piping Systems.

C. Measurement of Final Operating Condition of HVAC Systems.

1.3 RELATED SECTIONS

A. Section 014000 – Quality Requirements: Testing laboratory services: Employment of testing agency and payment for services.

B. Section 017700 –Closeout Procedures.

C. Division 23 – Warranty:
1. TAB warranties shall conform to guidelines indicated in Division 23 with all references to Mechanical Contractor changes to TAB Contractor.

1.4 REFERENCES

A. AABC - National Standards for Total System Balance.

B. ADC - Test Code for Grilles, Registers, and Diffusers.

C. ASHRAE 111 - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.

D. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

E. SMACNA - HVAC Systems Testing, Adjusting, and Balancing.

F. IDAT – Integrated Deliverables And Testing Plan

1.5 SUBMITTALS

A. Submit under provisions of Division 01 Section "Submittal Procedures."

B. Design Review Reports:
   1. Submit prior to commencement of construction under provisions of Division 01 Section "Quality Requirements."
   2. Review the Contract Documents, and indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

C. Preliminary Report Submittals:
   1. Prior to commencing work of this Section, and no more than 30 days after approval of TAB Agency submittals, submit report forms or outlines indicating adjusting, balancing, and equipment data required, with columns of design data filled in. By means of plan views, equipment profiles, and similar graphical descriptions, indicate where measurements will be taken.
   2. Submit the procedures to be used.

D. Field Reports: Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect/Engineer and for inclusion in operating and maintenance manuals.

E. Provide reports in letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

F. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty prior to commencing system balance.

G. Test Reports: Indicate data on AABC National Standards for Total System Balance forms, forms prepared following ASHRAE 111, or NEBB forms.

1.6 QUALITY ASSURANCE

A. Perform total system balance in accordance with AABC National Standards for Field Measurement and Instrumentation, Total System Balance, ASHRAE 111 or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

B. Instrument Calibration: Calibrate instruments every 6 months, or more frequently if Manufacturer requires same.

1.7 QUALIFICATIONS

A. Agency: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum three years experience and certified by AABC or NEBB, or equivalent experience which would qualify for membership in these testing organizations. Agency shall be listed under paragraph 3.1 AGENCIES in this Section.

B. Perform Work under supervision of registered Professional Engineer experienced in performance of this Work and licensed in Maine.

1.8 SEQUENCING

A. Sequence work under the provisions of Division 01 Section “Summary.”

B. Sequence work to commence after completion of systems or portions of work, and schedule completion of work before Substantial Completion of Project.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 AGENCIES

A. Tekon Technical Consultants, Rochester, NH. Contact: Charles Corlin, (603) 335-3080.

B. No Substitutions.

3.2 EXAMINATION

A. Verify that systems are complete and operating correctly in accordance with sequence of operations before commencing work. Ensure the following conditions:
1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Duct systems are clean of debris.
5. Fans are rotating correctly.
6. Fire and volume dampers are in place and open.
7. Air coil fins are cleaned and combed.
8. Access doors are closed and duct end caps are in place.
9. Air outlets are installed and connected.
10. Duct system leakage is minimized.
11. Hydronic systems are flushed, filled, and vented.
12. Pumps are rotating correctly.
13. Proper strainer baskets are clean and in place.
14. Service and balance valves are open.

B. Submit field reports. Report to the responsible Subcontractors, defects and deficiencies noted during performance of services which prevent system balance. Submit list of locations where the Contractor needs to provide additional balancing devices.

C. Beginning of work means acceptance of existing conditions.

3.3 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

3.4 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 5 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.5 ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

E. For belt driven equipment, provide sheave and belt modifications and/or replacements as required to ensure design flow rates as specified.

3.6 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide design supply, return, and exhaust air quantities.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, return air, and exhaust dampers for design conditions. Adjust at minimum position and maximum position, and use manual dampers and actuator limit stops to minimize differences.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. Coordinate with Division 23 Section "Instrumentation and Controls for HVAC" for calibration of supply air fans static pressure sensors and determination of pressure setpoints.

M. Set pattern-control vanes and other devices in air inlets and outlets to provide the spread and throw patterns indicated, without objectionable noise or air motion to the occupants. Split the flow of linear slot diffusers in directions as required for good coverage. At completion, patterns shall be uniform and pleasing to the eye.

3.7 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. 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.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing.

F. Where available pump capacity is less than total flow requirements of individual system parts (due to system diversity), full flow in one part may be simulated by temporary restriction of flow to other parts.

G. Coordinate with Division 23 Section "Instrumentation and Controls for HVAC" for calibration of pump static pressure sensors and determination of pressure setpoints.

H. When the available pump head is more than 15 percent above the required head to meet the design flow, trim the pump impeller to bring the head within 100 to 110 percent of the required head to meet the design flow. At least one balancing valve in the system, and one balancing valve per each multi-circuit sub-main branch served by a branch balancing valve, shall be fully open when balancing is complete.

3.8 COORDINATION OF SERVICES

A. The General Contractor and his Subcontractors shall be responsible for providing the following assistance to the TAB Agent:
   1. Provide access to the Contractors on site ladders and man-lifts as required to allow access to required equipment by the TAB Agent.
   2. Keep the TAB Agent informed of the project schedule and ensure that adequate notice is given to the TAB Agent to allow for the proper testing, adjusting and balancing of mechanical systems before ceilings are flooded or access to systems is otherwise obstructed.
   3. Ensure that adequate time is allotted in the project schedule to allow for the proper testing, adjusting and balancing of the mechanical systems.
   4. Coordinate with the TAB Agent to correct system deficiencies that are discovered by the TAB Agent. Notify the TAB Agent once system deficiencies are corrected.

3.9 PROJECT CLOSEOUT

A. Provide instrument calibration reports by type used for air and water procedures and dates of last

3.10 SCHEDULES

A. Equipment Requiring Testing, Adjusting, and Balancing:
   1. HVAC Pumps
   2. Heat Exchanger
   3. Supply Air Fans
   4. Glycol Hot Water Unit Heaters
   5. Baseboard Radiation
   6. Glycol Hot Water Heating Coils
   7. Exhaust Fan
   8. Fresh Air Intake to AC-1
   9. Air Inlets and Outlets

B. Report Forms:
   1. Title Page:
      a. Name of Testing, Adjusting, and Balancing Agency
      b. Address of Testing, Adjusting, and Balancing Agency
      c. Telephone number of Testing, Adjusting, and Balancing Agency
      d. Project name
      e. Project location
      f. Project Architect
      g. Project Engineer
      h. Project Contractor
      i. Project altitude
      j. Report date
   2. Summary Comments:
      a. Design versus final performance
      b. Notable characteristics of system
      c. Description of systems operation sequence

d. Summary of outdoor and exhaust flows to indicate amount of building pressurization
e. Nomenclature used throughout report
f. Test conditions

3. Instrument List:
   a. Instrument
   b. Manufacturer
   c. Model number
   d. Serial number
   e. Range
   f. Calibration date
4. Electric Motors:
   a. Manufacturer
   b. Model/Frame
   c. HP/BHP
   d. Phase, voltage, amperage; nameplate, actual, no load
   e. RPM
   f. Service factor
   g. Starter size, rating, heater elements
   h. Sheave Make/Size/Bore
5. V-Belt Drive:
   a. Identification/location
   b. Required driven RPM
   c. Driven sheave, diameter and RPM
   d. Belt, size and quantity
   e. Motor sheave diameter and RPM
   f. Center to center distance, maximum, minimum, and actual
6. Pump Data:
   a. Identification/number
   b. Manufacturer
   c. Size/model
   d. Impeller
   e. Service
   f. Design flow rate, pressure drop, BHP
   g. Actual flow rate, pressure drop, BHP
   h. Discharge pressure
   i. Suction pressure
   j. Total operating head pressure
   k. Shut off, discharge and suction pressures
   l. Shut off, total head pressure
7. Heating Coil Data:
   a. Identification/number
   b. Location
   c. Service
   d. Manufacturer
   e. Air flow, design and actual
   f. Water flow, design and actual
   g. Water pressure drop, design and actual
   h. Entering water temperature, design and actual
   i. Leaving water temperature, design and actual

j. Entering air temperature, design and actual
k. Leaving air temperature, design and actual
l. Air pressure drop, design and actual

8. Air Moving Equipment:
   a. Location
   b. Manufacturer
   c. Model number
   d. Serial number
   e. Arrangement/Class/Discharge
   f. Air flow, specified and actual
   g. Return air flow, specified and actual
   h. Outside air flow, specified and actual
   i. Total static pressure (total external), specified and actual
   j. Inlet pressure
   k. Discharge pressure
   l. Sheave Make/Size/Bore
   m. Number of Belts/Make/Size
   n. Fan RPM
9. Return Air/Outside Air Data:
   a. Identification/location
   b. Design air flow
   c. Actual air flow
   d. Design return air flow
   e. Actual return air flow
   f. Design outside air flow
   g. Actual outside air flow
   h. Return air temperature
   i. Outside air temperature
   j. Required mixed air temperature
   k. Actual mixed air temperature
   l. Design outside/return air ratio
   m. Actual outside/return air ratio
10. Exhaust Fan Data:
   a. Location
   b. Manufacturer
   c. Model number
   d. Serial number
   e. Air flow, specified and actual
   f. Total static pressure (total external), specified and actual
   g. Inlet pressure
   h. Discharge pressure
   i. Sheave Make/Size/Bore
   j. Number of Belts/Make/Size
   k. Fan RPM
11. Duct Traverse:
   a. System zone/branch
   b. Duct size
   c. Area
   d. Design velocity

e. Design air flow
f. Test velocity
g. Test air flow
h. Duct static pressure
i. Air temperature
j. Air correction factor

END OF SECTION 019500

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SECTION 024119 - SELECTIVE STRUCTURE DEMOLITION AND ALTERATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Demolition and removal of selected portions of a building.
   2. Disconnecting, capping or sealing, and abandoning utilities.
   3. Demolition and removal of selected site elements.
   4. Repair procedures for selective demolition operations.

B. Related Sections include the following:
   1. Division 01 Section "Cutting and Patching" for additional cutting and patching procedures for selective demolition operations.
   2. Division 01 Section "Construction Waste Management and Disposal" for handling and processing demolition and construction debris.
   3. Division 01 Section "Project Record Documents" for documentation of capped utilities and other subsurface structural, electrical or mechanical conditions.
   4. Divisions 22 and 23 Sections for additional requirements regarding demolishing, cutting, patching, or relocating mechanical items.
   5. Division 26 Sections for additional requirements regarding demolishing, cutting, patching, or relocating electrical items.

1.3 DEFINITIONS

A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Owner's property.

B. Remove and Salvage: Items indicated to be removed and salvaged remain the Owner's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to Owner's designated storage area.

C. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in locations indicated.

D. Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Architect, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.

1.4 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

B. Carefully remove items indicated to be salvaged in a manner to prevent damage and deliver promptly to the Owner.

C. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.

1.5 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

C. Proposed Dust-Control and Noise-Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.

D. Schedule of Selective Demolition Activities: Indicate the following:
1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Incorporate removal activities of Owner's abatement contractor as part of the schedule and sequence of demolition. Ensure Owner's adjacent on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4.
5. Detailed sequence of selective demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.
6. .
7.
8. Coordination of removals with the installation of new materials to prevent unauthorized entry into the building, and for protection of existing materials and finishes to remain from damage from the weather.

E. Inventory of items to be removed and salvaged.

F. Inventory of items to be removed by Owner.

G. Record Drawings at Project closeout according to Division 01 Section "Project Record Documents."

1. Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions.

H. Submit for record, permits and disposal information for the fuel oil tank removal and disposal.

I. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 QUALITY ASSURANCE

A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated.

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

D. Standards: Comply with ANSI A10.6 and NFPA 241.

E. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:
1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review shoring sequencing for maintaining existing structure without damage during removal of existing floor systems and structural components.
5. Review methods of protecting remaining surfaces in weathertight conditions without damage during selective demolition operations and ensuing time frame until exterior envelope can be made permanently weathertight.
6. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
7. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.
8. Provide 5 business days minimum advance notice to participants prior to convening predemolition conference.

1.7 PROJECT CONDITIONS

A. Conduct selective demolition so that Owner's operations will not be disrupted. Provide not less than 72 hours' to Owner of activities that will affect Owner's operations.

B. Owner assumes no responsibility for condition of areas to be selectively demolished.

1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Special Waste: Fuel oil tank, including the fuel oil residuals, underground piping and oil lines.
1. Special waste shall be removed and disposed of in accordance with applicable federal and state regulations, notifications and permits, including removal permit and filing notification of closure of underground storage tanks after removal. Waste disposal procedures are the sole responsibility of the Contractor, including removal, handling, transportation, and recycling and disposal of residual contents and materials in accordance with DEP/EPA regulations. Maintain records of disposed materials that shall include the list of materials, name and address of the transporter and recycler or disposal facility, date of shipment and date of receipt of materials, and dated signature of the receiver of the wastes.

D. Asbestos and PCB-Containing Materials: Asbestos or PCB-containing materials if present will be removed by the Owner's abatement contractor under a separate contract.
1. If materials suspected of containing asbestos are encountered during the course of construction, do not disturb; immediately notify Architect and Owner.
2. Coordinate demolition schedule and activities with the Owner's abatement contractor.
3. After the Owner's abatement contractor removes exterior asbestos or PCB-containing materials, the Contractor shall provide necessary temporary coverings and enclosures to maintain the building in a watertight condition.

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

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1.8 SCHEDULING

A. Arrange selective demolition schedule so as not to interfere with Owner's on-site operations.

PART 2 - PRODUCTS

2.1 REPAIR MATERIALS

A. Use repair materials identical to existing materials.
1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
2. Use materials whose installed performance equals or surpasses that of existing materials.

B. Comply with material and installation requirements specified in individual Specification Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.

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

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to the Architect.

E. Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.
   1. Engineer shall develop shoring and underpinning plans and procedures for removal of structural components indicated to be removed.

F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.
   1. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by Owner or authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to governing authorities.
      a. Provide not less than 72 hours' notice to Owner if shutdown of service is required during changeover.

B. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.
   1. Arrange to shut off indicated utilities with the Owner.
   2. Where utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.
   3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
   4. Existing piping, conduit, and panels to remain that are supported by walls and ceilings to be demolished, shall be temporarily re-supported to the existing structure until permanent construction is in place.

C. Utility Requirements: Refer to Divisions 22, 23 and 26 Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities outside limits of Work, without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by Owner or governing regulations.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section "Temporary Facilities and Controls."

C. Temporary Enclosures: Provide temporary enclosures for protection of existing building and construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.

D. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures and provide exhaust ventilation to limit dust and dirt migration and to separate areas from fumes and noise. Coordinate requirements and locations with the Architect and Owner.

E. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of construction to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of selective demolition.

F. Core Drilling and Saw Cutting: All penetrations shall be fully planned and coordinated by the Contractor. Vacuum up water created by cutting operations to prevent damage to materials to remain.

G. Enclose openings to the exterior and to unconditioned spaces to prevent heat loss and maintain temperature at an acceptable level for Owner.

H. Salvaged Items: Comply with the following:
1. Remove items to be salvaged carefully to prevent damage. Parts and pieces shall be placed in containers and labeled.
2. Clean salvaged items of dirt and demolition debris.
3. Store items in a secure area until delivery to Owner’s designated location.

4. Protect items from damage during transport and storage.

I. Contractor Removed and Reinstalled Items:
   1. Remove items to be salvaged carefully to prevent damage. Parts and pieces shall be placed in containers and labeled.
   2. Clean and repair items to functional condition adequate for intended reuse.
   3. Pack or crate items after cleaning and repairing. Identify contents of containers.
   4. Protect items from damage during transport and storage.
   5. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

3.4 POLLUTION CONTROLS

A. Dust Control: Use water mist, temporary enclosures, and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.
   1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

B. Disposal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
   1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

C. Cleaning: Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.5 SELECTIVE DEMOLITION

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
   2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
   3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
   4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during and after flame-cutting operations, until risk of fire has past.
   5. Maintain adequate ventilation when using cutting torches.
   6. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
   7. Break up and remove concrete slabs on grade and foundations where indicated.

8. Dispose of demolished items and materials promptly. On-site storage or sale of removed items is prohibited. Comply with requirements in Division 01 Section "Construction Waste Management and Disposal."
9. Remove and replace or reinstall existing construction as necessary to permit installation and alteration of mechanical and electrical work. Coordinate all removals with appropriate trades.
10. Return elements of construction and surfaces to remain to condition existing before start of selective demolition operations.

B. Filling Below-Grade Areas: Completely fill below-grade areas and voids resulting from demolition of buildings and pavements with soil materials according to requirements specified in Division 31Section "Earthwork."

C. Existing Facilities: Comply with Owner's requirements for using and protecting stairs, walkways, building entries, and other building facilities during selective demolition operations.

D. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.

E. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

F. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

G. Roofing: Remove no more existing roofing than can be covered in one day by new roofing. Refer to applicable Division 07 Section for new roofing requirements.

H. Existing Painted Floors: Where existing painted floors exist, remove paint down to bare concrete by shot blasting or grinding. Comply with paint removal requirements as applicable.

3.6 BRACING

A. Locate bracing to clear columns, and other permanent work. If necessary to move a brace, install new bracing prior to removal of original brace.

B. Do not place bracing where it will be cast into or included in permanent work, except as otherwise acceptable to Architect.

C. Install internal bracing, if required, to prevent spreading or distortion to braced frames.

D. Maintain bracing until structural elements are rebraced by other bracing or until permanent construction is able to withstand pressures.

3.7 PATCHING AND REPAIRS

A. General: Promptly repair damage to adjacent construction caused by selective demolition operations.

B. Patching: Comply with Division 01 Section "Cutting and Patching."

C. Work Exposed to View: Do not cut or patch in a manner that would, in the Architect's opinion, result in a lessening of the building's aesthetic qualities. Generally, cut from exposed side into concealed spaces to avoid unnecessary damage to finish. Do not cut and patch in a manner that would result in substantial visual evidence of cut and patch work. Restore exposed finishes of patched areas in a manner, which eliminates evidence of patching and refinishing. For continuous surfaces, extend refinish to nearest intersection, with a neat transition to adjacent surfaces.

D. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
   1. Completely fill holes and depressions in existing masonry walls that are to remain with an approved masonry patching material applied according to manufacturer's written recommendations.

E. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

F. Floors and Walls: Where walls or partitions that are demolished extend one finished area into another, patch and repair floor and wall surfaces in new space. Provide an even surface of uniform finish color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
   1. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
   2. Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
   3. Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

G. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.8 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

D. Waste Reduction: To the maximum extent possible, removals shall be salvaged or recycled. See Division 01 Section "Construction Waste Management and Disposal" for additional requirements.

3.9 CLEANING

A. Sweep the building broom clean on completion of selective demolition operation.

END OF SECTION 024119

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SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Footings.
   2. Foundation walls.
   3. Slabs-on-grade.
   4. Exterior concrete slabs and walks.
   5. Conrete slab trench patching

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
   1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement. Include special reinforcing required for openings through concrete structures.

D. Submit locations for construction and control joint layout for walls, slabs and exterior flatwork and walks.

E. Qualification Data: For ACI certified flatwork finisher certificate.

F. Submit for record, a written plan of the field procedures to be implemented for hot and cold weather protection.

G. Submit chart for application requirements of evaporation control.

1.4 QUALITY ASSURANCE

A. Installer Qualifications - Slabs: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

D. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301, "Specification for Structural Concrete."
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

1.5 FOUNDATION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly in writing.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Plywood, metal, or other approved panel materials.
   2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
      a. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
   2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60, deformed bars, assembled with clips.

2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

2.5 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
   1. Portland Cement: ASTM C 150, Type I or II, gray.

B. Supplementary Cementitious Materials (Permitted for Footings and Walls Only): Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.
   1. Maximum Coarse-Aggregate Size: ¾".
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

2.6 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A or Type F.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.7 FIBER REINFORCEMENT

A. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, 3/4 inches long.
   1. Products:
      a. Monofilament Fibers:
         1) Grace Construction Products, W. R. Grace & Co.; Grace MicroFiber.

2.8 CURING AND SEALING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
   1. Products:
      a. Dayton Superior Corporation; Sure Film.
      b. Euclid Chemical Company (The); Eucobar.
      c. L&M Construction Chemicals, Inc.; E-Con.
      d. MBT Protection and Repair, Div. of ChemRex; Confilm.
      e. Meadows, W. R., Inc.; Sealtight Evapre.
      f. Sika Corporation, Inc.; SikaFilm.
      g. Symons Corporation, a Dayton Superior Company; Finishing Aid.
      h. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.

B. Moisture-Retaining Cover: ASTM C 171, white polyethylene film or white burlap-polyethylene sheet.
   1. Exterior Flatwork: Disposable cellulose fabric with polyethylene film backing sheet. Non-staining fabric, designed to lay flat in intimate contact with slab surface to prevent discoloration.
      a. UltraCure NCF; McTech Group, Inc. or approved substitute.

C. Exterior Concrete Flatwork Sealer: Water-based silane/siloxane water repellant and chloride screen.
   1. Prosoco Consolideck Saltguard WB.

D. Water: Potable.

2.9 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D4819, Type II, two pound minimum density closed cell polyethylene with 1/2-inch deep top strip-off edge to allow installation of joint sealant; 1/2-inch thickness by full depth of slab.
   1. A.H. Harris; Harristrip-Off; Harris Polyethylene Joint Filler.
   2. Foam Peel HT; Foamtastic, division of Hohmann & Barnard or accepted equivalent.
   3. W.R. Meadows; Deck-O-Foam.

B. Joint-Filler Strips Left Exposed: ASTM D 1751, asphalt-saturated cellulosic fiber.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.10 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
   1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Admixtures: Use admixtures according to manufacturer's written instructions.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Foundation Walls and Footings: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: 3000 psi at 28 days.
   2. Maximum Water-Cementitious Materials Ratio: 0.54.
   3. Slump Limit: 4 inches, plus or minus 1-1/2 inches.
      a. 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture.
   4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery

B. Interior Slabs: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: 3000 psi at 28 days.
   2. Maximum Water-Cementitious Materials Ratio: 0.52.
   3. Slump Limit: 4 inches, plus or minus 1-1/2 inches.
      a. Slump for pumped concrete may be increased to compensate for slump loss in the hose by adding high-range water-reducing admixture or plasticizing admixture. Slump at the point of hose discharge shall not exceed 5-1/2 inches.
   4. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent. Entrapped air only, do not add air-entraining admixture.
   5. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd.
      a. Synthetic fibers not required for interior slabs on metal deck.
   6. Fly ash and slag cementitious materials are not permitted for slabs.

C. Exterior Slabs, Walks, Equipment Pads: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: 4500 psi at 28 days.
   2. Maximum Water-Cementitious Materials Ratio: 0.44.
   3. Slump Limit: 4 inches, plus or minus 1-1/2 inches.
   4. Air Content: 6.5 percent, plus or minus 1 percent at point of delivery.

2.12 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116, and furnish batch ticket information. Include on batch ticket the amount of water introduced into the mix at the plant, and amount of water that can be added later, and stay within the specified water-cementitious materials ratio.
   1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
   1. Class A, 1/8 inch for smooth-formed finished surfaces.
   2. Class C, 1/2 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Do not use rust-stained steel form-facing material for exposed surfaces.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not weld reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Reinforce stair pans with strips of 3 inch by 6 inch #10 wire mesh or two layers 6 inch by 6 inch #10 mesh overlapped, full width and depth of pan.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
   2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
   3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
   5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
   6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction (Control) Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, with a one inch minimum, as follows:
   1. Sawed Joints: Form contraction joints with Soff-Cut early-entry dry-cut control joint saw cutting. Install cuts at each control joint location as soon as concrete will support weight of saw and operator without disturbing final finish. Provide adequate equipment to complete cutting operations within 2 hours after final pass of trowel. Use Soff-Cut blades and skid plates, using a new skid plate with each new blade. Remove debris in path of cut and under skid plate before cutting. Install Soff-Cut joint protector at saw-cut intersection prior to cross-cut. Remove dry powder saw cut concrete spoils immediately without disturbing finish.
   2. Joint Width: 1/8-inch for slabs to receive floor coverings. 1/4-inch for joints to be left exposed and filled with joint sealant.
   3. Contraction joints shall be placed in accordance with approved Shop Drawings. The panel shall be as nearly square as possible. If panel cannot be square, do not exceed panel length to panel width ratio of 1 to 1-1/2. Conform to bay spacing wherever possible (at column centerlines, half bays, third bays, one quarter bays, or equal division to meet the specified spacing requirements).
   4. Make initial saw cut at mid-length of slab and proceed by saw-cutting at mid-length of each subsequent panel until all joints have been cut.
   5. Joints are not permitted in slabs of coolers or freezers.
   6. Avoid traffic across saw cut until sufficient strength is gained to protect joint edges.
   7. Saw cut slabs on grade in accordance with spacing indicated. Where not indicated, saw cut in accordance with the following maximum spacing:
      a. 4 inches thick slab: 8 feet.
      b. 5 to 6 inches thick: 10 feet.
      c. 6 1/4 to 7 inches thick: 12 feet.
      d. 7 1/4 to 8 inches thick: 14 feet.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
   1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
   2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Slab Joints: Install plate system and support assemblies at construction joints and joints where indicated.

F. Joints in Sidewalks and Exterior Flatwork: Radius edges of walks and outside edges of slabs with 1/4 inch radius edge tool.
   1. Saw cut joints, complying with contraction joint cutting requirements, unless indicated otherwise. Submit shop drawing of saw cut layout for approval.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect. Record water added at the Project site on batch ticket.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
   1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
   2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
   3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
   1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   2. Maintain reinforcement in position on chairs during concrete placement.
   3. Screed slab surfaces with a straightedge and strike off to correct elevations.
   4. Slope surfaces uniformly to drains where required.

5. Begin initial floating using bull floats to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces exposed to public view.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. If pan floats are used, the first floating shall be done by power trowel with conventional float blades to open surface to allow release of bleed water and prevent blistering. Bleedwater shall not be trapped beneath finished surface or finished back into slab surface. Restraighten, cut down high spots, and fill low spots as required to meet the

floor flatness and levelness tolerances. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a smooth trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, paint, or another thin-film-finish coating system.
    a. Trowel finish shall provide a smooth, uniform surface, with no ridges or swirl marks that would telegraph through floor coverings. Do not trowel to a shiny burnish surface. The intent is to provide a smooth even floor while leaving the surface texture open enough to permit drying of the slab to achieve required moisture content for floor covering installation.
        1) Provide a trowel finish test area and review surface finish with floor covering subcontractor.
2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
    a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.

D. Exterior Concrete Walks and Flatwork: Place concrete, screed and wood float surfaces to a smooth and uniform finish, free of open texturing and exposed aggregate. Avoid working bleed water into surface mortar.

1. Bull float directly behind screed before bleedwater appears.
2. Immediately behind bullfloat, drag broom across surface for a light broom finish if surface paste provides adequate stiffness to maintain acceptable surface texture. If bleedwater appears before application of broom finish, allow surface water to evaporate before brooming.
3. Coordinate required final broom finish with Architect before application.
4. Walks and slabs shall be flat at no greater than plus or minus 1/4 inch in 10 feet. Walks and slabs shall pitch to permit drainage, free of ponding water and bird baths.

3.9 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

C. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.10 CONCRETE PROTECTING, CURING AND SEALING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to concrete slab surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by the following methods:
   1. Moisture-Retaining-Cover Curing (Slabs receiving floor coverings, sealer, exterior walks and exterior slabs): Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   2. Clean slab before application of compound.
   3. Concrete shall remain above 40°F for a minimum of 28 days to permit proper curing before sealer application.

3.11 EXTERIOR CONCRETE FLATWORK SEALER

A. Exterior Concrete Flatwork Sealer: Apply sealer to all exterior horizontal surfaces including, walks, entrance slabs, plazas, landings, concrete steps and ramps.
   1. Allow concrete to dry for a minimum of 7 days after moisture retaining curing methods are removed.
   2. Concrete surface and air temperatures during application and for at least 8 hours following shall be above 40°F.
   3. Apply sealer to clean dry surface in accordance with manufacturer’s application instructions. Keep surface wet with sealer to permit penetration. Broom out puddles thoroughly until all sealer has penetrated the surface.

3.12 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Formed Surfaces Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch(13 mm) in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
   2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
   3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
   1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
   2. After concrete has cured at least 14 days, correct high areas by grinding.
   3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
   4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
   5. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
   6. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.13 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing agency to perform field tests and and prepare test reports.

B. Inspections:
   1. Steel reinforcement placement.
   2. Verification of use of required design mixture.
   3. Concrete placement, including conveying and depositing.
   4. Curing procedures and maintenance of curing temperature.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
   1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
      a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
      b. When total quantity of a given class of concrete is less than 50 cu. yd., Architect may waive strength testing if adequate evidence of satisfactory strength is provided.
   2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
   3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
   5. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
      a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
      b. Properly store cylinders while awaiting transport to laboratory, maintaining temperature between 60 deg F and 80 deg F. Protect cylinders from being hit, damaged, and from vibration during initial set. Deliver to laboratory for curing within 24 hours of casting test specimen.
      c. Field-Cured Cylinders: For cold weather concrete operations when formwork is exposed to below freezing temperatures, where directed by the Architect, prepare an additional set of four standard cylinders to be cured at the site, maintaining cylinders in the conditions and at the temperature of the in-place concrete. Protect field cylinders from being hit, damaged, and from vibration during initial set.
   6. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
   7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

8. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the Work that test reports and inspections indicate dos not comply with the Contract Documents.

END OF SECTION 033000

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SECTION 034500 - PLANT-PRECAST ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes precast architectural concrete units including, but not limited to, the following:
   1. Steps and landing
   2. Canopy column bases

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Engineer, fabricate, and install precast architectural concrete units and connections capable of withstanding design loads within limits and under conditions indicated.

B. Engineering Responsibilities: Engage a fabricator who utilizes a qualified registered professional structural engineer to prepare design calculations, Shop Drawings, and other structural data for architectural precast concrete units, including connections.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product indicated.

C. Design Mixes: For each concrete mix.

D. Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication and installation of precast architectural concrete units. Indicate member locations, plans, elevations, dimensions, shapes, cross sections, limits of each finish, types of reinforcement, including special reinforcement, and layout of anchorage devices. Include locations and details of hoisting points and lifting devices for handling and erection.
   1. Indicate welded connections by AWS standard symbols. Detail loose and cast-in hardware, inserts, connections, and joints, including accessories.
   2. Indicate locations and details of anchorage devices to be embedded in or attached to structure or other construction.
   3. Indicate location of each architectural precast concrete unit by same identification mark placed on panel.
   4. Indicate relationship of architectural precast concrete units to adjacent materials.
   5. Comprehensive engineering analysis signed and sealed the qualified professional structural engineer responsible for its preparation.

E. Samples: For each type of color and finish indicated on exposed surfaces of precast architectural concrete units, in sets of 3, illustrating full range of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches.

F. Welding Certificates: Signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

G. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

H. Quality-Control Testing Report: Submit results of tests reports performed for the precast architectural concrete units fabricated for the project.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced Installer who has completed precast architectural concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Fabricator Qualifications: A firm that complies with the following requirements and is experienced in manufacturing precast architectural concrete units similar to those indicated for this Project and with a record of successful in-service performance.
   1. Assumes responsibility for engineering precast architectural concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
   2. Professional Engineer Qualifications: Professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of precast architectural concrete that are similar to those indicated for this Project in material, design, and extent.
   3. Participates in PCI's Plant Certification program and is designated a PCI-certified plant for Group A, Category A1--Architectural Cladding and Load Bearing Units or in APA's Plant Certification Program for Production of Architectural Precast Concrete Products and is designated an APA-certified plant.
   4. Has sufficient production capacity to produce required units without delaying the Work.

C. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

D. Design Standards: Comply with ACI 318 and the design recommendations of PCI MNL 120, "PCI Design Handbook--Precast and Prestressed Concrete."

E. 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."

F. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel"; and AWS D1.4, "Structural Welding Code--Reinforcing Steel."

G. Design modifications may be made as necessary to meet field conditions and to ensure proper fitting of the Work as acceptable to the Architect. Maintain general design concept shown

without increasing or decreasing sizes of architectural precast concrete units or altering profiles and alignments shown. Revise and submit complete design calculations and Drawings prepared by a qualified professional engineer when design modifications are required.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver precast architectural concrete units to Project site in such quantities and at such times to ensure continuity of installation. Store units at Project site to prevent cracking, chipping, distorting, warping, staining, or other physical damage, and so markings are visible during storage.
   1. Prevent staining and discoloration of stacked units during storage. Replace units or clean and obtain Architect's approval before installation. Replace units that cannot be cleaned to Architect's approval.

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

C. Place stored units so that lifting devices are accessible and undamaged.

D. Handle and transport units in a position consistent with their shape and design in order to avoid excessive stresses, which would cause cracking, damage, or chipping of corners and edges.

E. Lift and support units only at designated lifting and supporting points as shown on Shop Drawings.

1.7 SEQUENCING

A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fabricators:
   1. Northern Design Precast Inc., Loudon, NH; contact: Jesse Thompson; website: www.ndprecast.com; phone: (603) 783-8989.
   2. MGA Cast Stone, Inc., Oxford, ME; contact: Greg Hamann; e-mail: greg@mgacaststone.com; phone: (207) 539-6035.

2.2 MOLD MATERIALS

A. Molds: Provide molds and, where required, form-facing materials of metal, plastic, wood, or another material that is nonreactive with concrete and dimensionally stable to produce continuous and true precast concrete surfaces within fabrication tolerances and suitable for required finishes.

2.3 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

C. Plain-Steel Wire: ASTM A 82, as drawn.

D. Deformed-Steel Wire: ASTM A 496.

E. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from galvanized steel wire into flat sheets.

F. Deformed-Steel Welded Wire Fabric: ASTM A 497, flat sheet.

G. Supports: Manufacturer's bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place according to CRSI's "Manual of Standard Practice," PCI MNL 117, and as follows:
   1. For uncoated reinforcement, use all-plastic bar supports.

2.4 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type III, white, of same type, brand, and source throughout Project, except as noted.

B. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33, with coarse aggregates complying with Class 5S.
   1. Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining.
      a. Gradation: Uniformly graded to match design reference sample.
   2. Fine Aggregates: Selected, natural or manufactured sand of the same material as coarse aggregate, unless otherwise approved by Architect.

C. Coloring Admixture: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures, temperature stable, nonfading, and alkali resistant.
   1. Product: Solomon Grind-Chem Services, Inc.; Dry Integral Color.

D. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.

E. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

F. Water-Reducing Admixture: ASTM C 494, Type A.

G. Retarding Admixture: ASTM C 494, Type B.

H. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.5 CONCRETE MIXES

A. Prepare design mixes for each type of concrete required.

B. Design mixes may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast architectural concrete fabricator's option.

C. Limit water-soluble chloride ions to the maximum percentage by weight of cement permitted by ACI 318.

D. Normal-Weight Concrete: Proportion mixes 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.
   2. Maximum Water-Cementitious Materials Ratio: 0.42.

E. Water Absorption: 12 to 14 percent by volume, tested according to PCI MNL 117.

F. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content complying with PCI MNL 117 and the following:
   1. Air content shall be not less than 6 percent and not more than 8 percent.

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

2.6 MOLD FABRICATION

A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing operations.

B. Maintain molds to provide completed precast architectural concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.

2.7 FABRICATION

A. 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.

B. Furnish loose steel seat angles, anchors, dowels, shims, hangers, and other hardware shapes for securing precast architectural concrete units to supporting and adjacent construction.

C. Cast-in holes, and other accessories in precast architectural concrete units to receive anchors. Coordinate with other trades for installation of cast-in items.

D. Reinforcement: Comply with recommendations in CRSI's "Manual of Standard Practice" and 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.
   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 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. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

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

F. Mix concrete according to PCI MNL 117 and requirements in this Section. After concrete batching, no additional water may be added.

G. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units. Comply with requirements in PCI MNL 117 for measuring, mixing, transporting, and placing concrete.

H. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with PCI MNL 117.

I. Comply with ACI 306.1 procedures for cold-weather concrete placement.

J. Comply with ACI 305R recommendations for hot-weather concrete placement.

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

L. 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.

M. Discard precast architectural concrete units that are warped, cracked, broken, spalled, stained, or otherwise defective unless repairs, made in a manner that complies with specification requirements, are approved by Architect.

2.8 FABRICATION TOLERANCES

A. Fabricate precast architectural concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished panel complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.

B. Fabricate precast architectural concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished panel complies with the following product tolerances in accordance with PCI MNL 117 product tolerances as well as position tolerances for cast-in items:
   1. Overall Height and Width of Units, Measured at the Face Exposed to View: As follows:
      a. 10 feet or under, plus or minus 1/8 inch.
      b. 10 to 20 feet, plus 1/8 inch, minus 3/16 inch.
      c. 20 to 40 feet, plus or minus 1/4 inch.
      d. Each additional 10 feet, plus or minus 1/16 inch.
   2. Overall Height and Width of Units, Measured at the Face Not Exposed to View: As follows:
      a. 10 feet or under, plus or minus 1/4 inch.

b. 10 to 20 feet, plus 1/4 inch, minus 3/8 inch.
c. 20 to 40 feet, plus or minus 3/8 inch.
d. Each additional 10 feet, plus or minus 1/8 inch.

3. Total Thickness or Flange Thickness: Plus 1/4 inch, minus 1/8 inch.
4. Rib Thickness: Plus or minus 1/8 inch.
5. Rib to Edge of Flange: Plus or minus 1/8 inch.
6. Distance between Ribs: Plus or minus 1/8 inch.
7. Variation from Square or Designated Skew (Difference in Length of the Two Diagonal Measurements): Plus or minus 1/8 inch per 72 inches or 1/2 inch total, whichever is greater.
8. Length and Width of Block-outs and Openings within One Unit: Plus or minus 1/4 inch.
9. Bowing: Plus or minus L/360, maximum 1 inch.
10. Local Smoothness: 1/4 inch per 10 feet.
11. Warping: 1/16 inch per 12 inches of distance from the nearest adjacent corner.
12. Tipping and Flushness of Plates: Plus or minus 1/4 inch.
13. Dimensions of Architectural Features and Rustications: Plus or minus 1/8 inch.

C. Position Tolerances: For cast-in items measured from datum line location, as indicated on Shop Drawings.
1. Weld Plates: Plus or minus 1 inch.
2. Inserts: Plus or minus 1/2 inch.
3. Handling Devices: Plus or minus 3 inches.
4. Reinforcing Steel and Welded Wire Fabric: Plus or minus 1/4 inch where position has structural implications or affects concrete cover; otherwise, plus or minus 1/2 inch.
5. Reinforcing Steel Extending out of Member: Plus or minus 1/2 inch of plan dimensions.
6. Tendons: Plus or minus 1/4 inch, vertical; plus or minus 1 inch, horizontal.
7. Location of Opening within Panel: Plus or minus 1/4 inch.

2.9 FINISHES

A. Finish exposed-face surfaces of precast architectural concrete units as follows:
1. Color of Precast Units: As indicated in Exterior Materials Legend.
2. Abrasive-Blast Finish: Use abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.
a. Provide light sandblast finish.

B. Finish exposed top, bottom, and back surfaces of precast architectural concrete units to match face-surface finish.

C. Finish unexposed surfaces of precast architectural concrete units by float finish.

2.10 SOURCE QUALITY CONTROL

A. Owner may employ an independent testing agency to evaluate precast architectural 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 mixes as may be requested for additional testing and evaluation.

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

C. Strength of precast concrete units will be considered deficient if units fail to comply with ACI 318 requirements.

D. Testing: If there is evidence that the strength of precast concrete units may be deficient or may not comply with ACI 318 requirements, Owner 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.
   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 the average compressive strength is equal to at least 85 percent of the 28-day design compressive strength and no single core is less than 75 percent of the 28-day design compressive strength.
   4. Test results will be made in writing on the same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports will include the following:
      a. Project identification name and number.
      b. Date when tests were performed.
      c. Name of precast concrete fabricator.
      d. Name of concrete testing agency.
      e. Identification letter, name, and type of precast concrete unit or units represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
   5. Retesting of replacement units will be paid for by fabricator.

E. Patching: If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mix that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.

F. Defective Work: Precast architectural concrete units that do not comply with requirements, including strength, manufacturing tolerances, and finishes, are unacceptable. Replace with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.
   1. Inspect precast units for chips and discoloration in presence of Architect and Owner's Representative before installation. Replace units found to be unacceptable.

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

C. Do not install precast concrete units until supporting concrete has attained minimum design compressive strength.

3.2 INSTALLATION

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

B. Install precast architectural concrete units plumb, level, 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. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
   2. Remove projecting hoisting devices and use mortar to fill voids within recessed hoisting devices flush with surface of concrete.

C. Completely seal around anchor pins on lintel angles that penetrate flashing with bituminous flashing and elastomeric sealant. Remove temporary shims, wedges, and spacers as soon as possible after anchoring and mortar operations are completed.

D. Welding: Perform welding in compliance with AWS D1.1 and AWS D1.4, with qualified welders.
   1. Protect precast architectural concrete units from damage by field welding or cutting operations and provide noncombustible shields as required.
   2. Repair damaged steel surfaces by cleaning and applying a coat of galvanizing repair paint to galvanized surfaces.

E. At bolted connections, use tack welds to prevent loosening of nuts.

3.3 ERECTION TOLERANCES

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

3.4 REPAIRS

A. Repair exposed exterior surfaces of precast architectural concrete units to match color, texture, and uniformity of surrounding precast architectural concrete, made in a manner that complies with specification requirements, if permitted by Architect.

B. Remove and replace damaged precast architectural concrete units if repairs do not comply with requirements.

3.5 CLEANING

A. Clean exposed surfaces of precast concrete units after erection to remove weld marks, other markings, dirt, and stains.
   1. Wash and rinse according to precast concrete fabricator's written recommendations. Protect other work from staining or damage due to cleaning operations.
   2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes.

END OF SECTION 034500

SECTION 039300 - CONCRETE SEALER

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Concrete sealer for new interior exposed slabs.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original and unopened containers and labeled with type and name of products and manufacturers.

B. Comply with manufacturer's written instructions for minimum and maximum temperature requirements and other conditions for storage.

PART 2 – PRODUCTS

2.1 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment (Sealer): Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Curecrete Distribution Inc.; Ashford Formula.
      b. Dayton Superior Corporation; Day-Chem Sure Hard (J-17).
      c. Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.
      d. L&M Construction Chemicals, Inc.; Seal Hard.
      e. Vexcon Chemicals, Inc.; Vexcon StarSeal PS Clear.

PART 3 – EXECUTION

3.1 PREPARATION

A. Mask walls, base, frames, mop sinks, equipment doors, frames and other surfaces that could receive sealer spatter during application.

B. Slab Preparation for Penetrating Sealer: Scrub floor with scotch brite pads and cleaning solution to remove coatings, joint compound, paint, stains, dirt, dust and other surface contaminates. Thoroughly rinse with clean potable water and dry surface, providing smooth clean surface to receive sealer.

3.2 INSTALLATION

A. Penetrating Sealer: Prepare, apply, and finish penetrating liquid floor treatment according to penetrating sealer manufacturer's written instructions.
   1. Surface shall be dry and clean, free of dirt, dust, and stains. If surface is dirty from construction operations, clean surface with scrubbing machine and squeegee/vacuum water from surface. Surface shall be cured and dry before application.
   2. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Do not allow sealer to dry on surface. Rinse with water; remove excess material until surface is dry.

END OF SECTION 039300

SECTION 042000 - UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:
   1. Concrete masonry units (CMUs).
   2. Face brick.
   3. Mortar and grout.
   4. Reinforcing steel.
   5. Masonry joint reinforcement.
   6. Ties and anchors.
   7. Embedded flashing.
   8. Miscellaneous masonry accessories.
   9. Masonry waste disposal.

B. Related Sections include the following:
   1. Division 07 Section "Sheet Metal Flashing and Trim" for exposed sheet metal flashing.
   2. Division 07 Sections "Penetration Firestopping" for firestopping at openings in masonry walls and "Fire Resistive Joint Systems" for firestopping joints at fire-rated masonry walls.
   3. Division 07 Section "Joint Sealants" for sealing control and expansion joints in unit masonry.

C. Products installed, but not furnished, under this Section include the following:
   1. Steel lintels for unit masonry, furnished under Division 05 Section "Metal Fabrications."
   2. Counterflashing in masonry joints for metal flashing, furnished under Division 07 Section "Sheet Metal Flashing and Trim."
   3. Steel frames for doors set in unit masonry openings, furnished under Division 08 Section "Hollow Metal Doors and Frames."

1.3 DEFINITIONS

A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional structural engineer, as defined in Division 01 Section "Quality Requirements," to design layout and spacing of masonry veneer anchors.

B. Design Wind Pressures for Wall Components:
   1. Corner Pressures: +19 lbf/sq. ft. and -23 lbf/sq. ft.
   2. Field-of-Building Pressures: +19 lbf/sq. ft. and -21 lbf/sq. ft.

1.5 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product indicated.

C. Shop Drawings: For the following:
   1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
   2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
   3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

D. Delegated-Design Data for Masonry Veneer Anchors: For masonry veneer anchors indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Samples for Initial Selection: For the following:
   1. Weep holes/vents showing colors available.

F. Samples for Verification: For each type and color of the following:
   1. Exposed concrete masonry units.
   2. For each color and texture of face brick, in the form of straps of five or more bricks.

G. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

H. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
   1. Masonry Units.
      a. Include material test reports substantiating compliance with requirements.
      b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
      c. For masonry units used in fire-rated assemblies, provide certificate establishing fire-resistance rating of units.
   2. Cementitious materials. Include brand, type, and name of manufacturer.
   3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
   4. Grout mixes. Include description of type and proportions of ingredients.
   5. Reinforcing bars.
   6. Joint reinforcement.
   7. Anchors, ties, and metal accessories.

I. Submit samples of sand to an approved laboratory for tests. Submit test report for approval.

J. Cold- and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

K. Installation Inspection Report: Submit report of completed work inspection, for each area that is completed and ready to turn over for application of the air/vapor barrier system.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this Section with minimum 5 years experience.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.

D. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

E. Mockups: Build mockup panels to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution with each trade providing components of their work.
   1. Prepare mockups for review at Preinstallation Conference.
   2. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
   3. Protect accepted mockups from the elements with weather-resistant membrane. Maintain approved mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   4. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
      a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
      b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
   5. Demolish and remove mockups when directed by Architect.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
   1. Parties that shall be present shall include the Owner, Architect, masonry subcontractor, masonry subcontractor's field superintendent and field workers performing the actual application, air/vapor barrier applicator, and installers whose work interfaces with or affects unit masonry assemblies, including but not limited to installers of storefront, curtain wall, and doors.
   2. Review mockup.
   3. Review tooling requirements for masonry receiving air/vapor barrier membrane.
   4. Review procedures and installation requirements of flexible and metal flashings.
   5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.
   6. Provide 5 business days minimum advance notice to participants prior to convening preinstallation conference.

G. Installation Inspection: Contractor and Installer shall inspect completed masonry backup installation for compliance with installation specifications and details and submit a report for each area that is completed and ready to turn over for application of the air/vapor barrier system. Report shall include the following:
   1. Verify masonry joints are completely filled and free of voids and lumps.
   2. Verify masonry joints are tooled slightly concave.
   3. Verify that masonry reinforcing with pintels is at the specified spacing.
   4. Verify that masonry pintels are free of mortar droppings.
   5. Verify foundation ledge is clean and free of mortar droppings.
   6. Verify through wall flashings are at installed at specified locations.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

F. Protect plastic insulation as follows:
   1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
   2. Store insulation on pallets of blocking not less than 4 inches above grade. Insulation stored directly on ground may void insulation warranty.
   3. Protect insulation with a waterproof covering, and ventilate to avoid condensation. Wrapping materials used for shipping are not adequate for weather protection at job site.
   4. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
   5. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.
   6. Maintain in dry condition. Do not install wet insulation within exterior wall assemblies.
   7. Do not install damaged insulation.

1.8 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
   2. Protect sills, ledges, and projections from mortar droppings.
   3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
   4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602 and the following:
   1. Cold-Weather Construction: When the ambient temperature is within the limits indicated, use the following procedures:
      a. 40 to 32 deg F: Heat mixing water or sand to produce mortar temperatures between 40 and 120 deg F.
      b. 32 to 25 deg F: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F. Heat grout materials to produce grout temperatures between 40 and 120 deg F. Maintain mortar and grout above freezing until used in masonry.
      c. 25 to 20 deg F: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F. Heat grout materials to produce grout temperatures between 40 and 120 deg F. Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F if grouting. Use heat on both sides of walls under construction.
      d. 20 deg F and Below: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F. Heat grout materials to produce grout temperatures between 40 and 120 deg F. Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F. Provide enclosures and use heat on both sides of walls under construction to maintain temperatures above 32 deg F within the enclosures.
   2. Cold-Weather Protection: When the mean daily temperature is within the limits indicated, provide the following protection, this is in addition to construction procedures specified above:
      a. 40 to 25 deg F: Cover masonry insulating blankets for 48 hours after construction.
      b. 25 deg F and Below: Provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 72 hours after construction.
   3. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

1. When ambient temperature exceeds 100 deg F, or 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not uses units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.3 CONCRETE MASONRY UNITS (CMUs)

A. Shapes: Provide shapes indicated and as follows:
   1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
   2. Provide bullnose units for exposed outside corners, unless otherwise indicated.

B. Concrete Masonry Units: ASTM C 90.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
   2. Weight Classification: Normal weight, unless otherwise indicated.
   3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
   4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
   5. Provide fire-rated block with ratings at locations indicated. Fire-rated block shall meet the requirements of IBC 2009.

C. Concrete Building Brick: ASTM C 55.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2500 psi.
   2. Weight Classification: Normal weight.
   3. Size: Manufactured to dimensions 3/8 inch less than nominal dimensions.

2.4 MASONRY LINTELS

A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout.

Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.5 BRICK

A. General: Provide shapes indicated and as follows for each form of brick required:
   1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
   2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
   3. Provide special shapes as indicated and for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
   4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Face Brick: ASTM C 216, Grade SW, Type FBS.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of not less than 8000 psi.
   2. Initial Rate of Absorption: Less than 18 g/30 sq. in. per minute when tested per ASTM C 67.
   3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
   4. Size (Actual Dimensions):
      a. Brick Veneer: 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
      b. Special shapes shall have be dimensions indicated.
   5. Application: Use where brick is exposed, unless otherwise indicated.
   6. Color and Texture: As indicated.
   7. Products:
      a. Brick Veneer #1: Match existing

C. Building (Common) Brick: ASTM C 62, Grade SW.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of not less than 8000 psi.
   2. Size: Match size of face brick.
   3. Application: Use where brick is indicated for concealed locations.

2.6 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S. Standard masonry cement is not acceptable. Provide one of the following portland cement-lime mix products:
   1. Eaglebond; Lafarge North America Inc.
   2. Portland and lime; Cement Quebec, Inc.
   3. Portland and lime Quikrete; The Quikrete Companies.

D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar. Pigmented mortar used
   1. Products: Solomon Grind-Chem Services, Inc.; SGS Mortar Colors.
      a. Colors for pigmented mortar as selected by Architect from manufacturer's full range of options.
      b. Pigmented mortar used with Brick Veneer Types #1.

E. Aggregate for Mortar: ASTM C 144.
   1. For mortar that is exposed to view, use washed aggregate consisting of natural sand.

F. Aggregate for Grout: ASTM C 404.

G. Water: Potable.

2.7 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

2.8 MASONRY JOINT REINFORCEMENT

A. Masonry Joint Reinforcement, General: ASTM A 951.
   1. Interior Walls: Hot-dip galvanized, carbon steel.
   2. Exterior Walls: Hot-dip galvanized, carbon steel.
   3. Wire Size for Side Rods - Exterior Walls: W2.8 or 0.188-inch diameter.
   4. Wire Size for Side Rods - Interior Walls: W1.7 or 0.148-inch diameter.
   5. Wire Size for Cross Rods: W1.7 or 0.148-inch diameter.
   6. Wire Size for Veneer Ties: W1.7 or 0.148-inch diameter.
   7. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
   8. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

B. Masonry Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.
   1. Products:
      a. Interior Block Walls: Continuous ladder type, ASTM A 641, hot dip galvanized, No. 9 wire.
         1) Heckman Building Products, Inc.; No. 1100 Ladder.
         2) Hohmann & Barnard, Inc.; Lox-All Ladder-Mesh.
         3) Wire Bond; Ladder Series 200.

2.9 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with eight subparagraphs below, unless otherwise indicated.
   1. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304 or 316.
   2. Stainless-Steel Sheet: ASTM A 666, Type 304.
   3. Stainless Steel Bars: ASTM A 276 or ASTM A 666, Type 304.

B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.

C. Adjustable Masonry-Veneer Anchors:
   1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to metal studs and concrete masonry units (CMUs), and as follows:
      a. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
   2. Screw-Attached, Masonry-Veneer Anchors with CMU: Units consisting of a wire tie and an adjustable metal anchor section.
      a. Product: Hohmann & Barnard, Inc.; HB-5213 Adjustable Veneer Anchor.

2.10 MISCELLANEOUS ANCHORS

A. Anchor Bolts: Steel bolts, L-shaped, complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

B. Postinstalled Anchors: Provide chemical or torque-controlled expansion anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or grouted unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
   1. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).
   2. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.

2.11 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with SMACNA's "Architectural Sheet Metal Manual, Division 07 Section "Sheet Metal Flashing and Trim," and as follows:
   1. Tin-Zinc Alloy Coated Copper: Temper H00 or H01, cold-rolled copper sheet, 16-oz./sq. ft. weight or 0.0216 inch thick, coated with tin-zinc alloy and a protective washcoat.
      a. Product: FreedomGray; Revere Copper Products, Inc.
   2. Fabrication: Form metal flashing to required shape using sheet metal break.
      a. Fabricate metal flashing with drip edge. Fabricate by extending flashing 3/8 inch out from wall, with outer edge bent down 45 degrees.
         1) Lintel head flashings shall be fabricated with ends turned up and inside corners soldered. Metal flashing shall extend horizontally across lintel angle, up the vertical leg, and across the cavity to support the flexible flashing tie-in to the air/vapor barrier.

B. Flexible Flashing: For flashing not exposed to the exterior, use the following, unless otherwise indicated:
   1. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch.
      a. Coordinate flashing and mastic with manufacturer of air/vapor barrier system. If proposed flashing system is not from the air/vapor barrier manufacturer being used

on the project, it is the responsibility of the mason contractor to obtain and submit a statement of compatibility from the air/vapor barrier system being used on the project.

b. Products:
   1) Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
      a) Termination Mastic: CCW-704 rubberized bitumen mastic. Coordinate mastic and flashing with manufacturer of air/vapor barrier system.
   2) Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing.
      a) Termination Mastic: Bituthene Mastic. Coordinate mastic and flashing with manufacturer of air/vapor barrier system.
   3) Henry Company; Blueskin TWF Thru-Wall Flashing.
      a) Termination Mastic: Polybitume 579-05. Coordinate mastic and flashing with manufacturer of air/vapor barrier system.

C. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.12 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane, or PVC.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Weep/Vent Products: Use the following, unless otherwise indicated:
   1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
      a. Products:
         1) Hohmann & Barnard, Inc.; Quadro-Vent.
         2) Wire-Bond; Cell Vent.

E. Cavity Drainage Material: Free-draining mesh, made from nonabsorbent, polymer strands that will not degrade within the wall cavity.
   1. Configuration: Strips, full-depth of cavity and 10 inches wide, with dovetail shaped notches 7 inches deep that prevent mesh from being clogged with mortar droppings.
   2. Thickness: 2-inches.
   3. Product: Mortar Net; Mortar Net USA, Ltd.

F. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from

0.142-inch steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.

1. Products:
    a. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
    b. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
    c. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

2.13 MASONRY CLEANERS

A. Job-Mixed Detergent Solution: Solution of 1/2-cup dry measure tetrasodium polyphosphate (Spic and Span) and 1/2-cup dry measure laundry detergent dissolved in 1 gal. of water.

B. Proprietary Buffered Detergent-Based Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry and precast concrete surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned. Muriatic acid is not permitted.

1. Cleaners for Brick: EaCoChem; NMD 80.

2.14 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Limit cementitious materials in mortar for exterior and reinforced masonry to portland cement and lime.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with BIA Technical Notes 8A, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, use Type S.
3. For exterior veneer masonry, use Type N.

D. Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments shall not exceed 10 percent of portland cement by weight.

E. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

F. Concrete for Unit Masonry: 3000 psi, 28-day compressive strength. Comply with requirements of Division 03 Section "Cast-In-Place Concrete."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
   1. If unsatisfactory conditions are encountered, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
   2. Verify that foundations are within tolerances specified.
   3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping and electrical systems to verify actual locations of piping and electrical connections.

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

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
   1. Mix units from several pallets or cubes as they are placed.

F. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
   1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
   2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
   3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
   4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.

5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.
7. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated. Grout cores solid minimum of 16-inches each side of openings.

G. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

H. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
1. Install compressible filler in joint between top of partition and underside of structure above.

I. At fire-rated walls and partitions, coordinate size of joint between top of masonry and underside of structure and between masonry and adjacent construction to comply with Division 07 Section "Fire-Resistive Joint Systems."

3.4 MORTAR BEDDING AND JOINTING

A. Lay hollow concrete masonry units as follows:
1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.

3. With webs fully bedded in mortar in grouted masonry.

B. Lay solid masonry units, including brick veneer, with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
   1. Full head joints in masonry veneer are required to make wall as water impermeable as possible. If field observations find head joints are not fully filled, the contractor will be required to remove brick at random locations as directed by the Architect. If additional locations are found with partially filled head joints, the masonry veneer shall be removed and new masonry veneer properly laid.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

3.5 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
   1. Space reinforcement not more than 16 inches o.c.
   2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
   3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.
      a. Reinforcement above is in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.6 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
   1. Where control joints are not shown, provide control joints at a maximum spacing of 30 feet; review proposed locations with Architect prior to installation.

B. Form control joints in concrete masonry as follows:
   1. Install preformed control-joint gaskets designed to fit standard sash block.

C. Form expansion joints in brick as follows:
   1. Build in compressible joint fillers where indicated.
   2. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants."

D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07 Section "Joint Sealants," but not less than 3/8 inch.
   1. Locate horizontal, pressure-relieving joints beneath relieving angles supporting masonry.

3.7 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and at all exposed block locations.

C. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.8 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows, unless otherwise indicated:
   1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as specified.
   2. Flexible flashing shall not span across a gap greater than 1/4-inch.
   3. Extend sheet metal flashing 3/8 inch beyond face of masonry at exterior and turn flashing down at 45 degrees to form a drip. Lap joints of metal flashing 3 inches, sealing between with full bed of asphalt mastic. Over the top of each joint, apply a 4-inch wide strip of flexible sheet flashing to both horizontal and vertical legs.
   4. Flexible Flashing Tie-In to Air/Vapor Barrier: Prepare surface of air/vapor barrier in accordance with air/vapor barrier manufacturer to receive flexible flashing. Run flexible flashing up face of air/vapor barrier 8 inches minimum. Flexible flashing shall be smooth, free of gaps and wrinkles. Roll surface of flexible flashing with hand roller to ensure full adhesion over the entire surface. Apply continuous bead of termination mastic along flexible flashing top edge, vertical edges, seams, cuts, and penetrations.
   5. Base of Wall Flashing: Provide 3-1/2-inch wide metal drip flashing and flexible flashing. Lap flexible flashing onto sheet metal drip flashing 3 inches, stopping flexible flashing minimum 1/2-inch back from face of brick, providing continuous watertight seal between. Extend flexible flashing fully supported across mortar filled cavity and turning up wall 8 inches minimum, tying into air/vapor barrier system as specified above.
   6. At lintels, provide metal flashing extending a minimum of 8 inches into masonry at each end, turning up not less than 2 inches to form end dams with inside corners soldered. Metal flashing shall extend horizontally across lintel angle, up the vertical leg, and across the cavity to support the flexible flashing tie-in to the air/vapor barrier.
      a. Metal flashing shall be one piece, full width of opening. Where opening width exceeds available sheet metal length, lap joints of metal flashing 3 inches, sealing between with full bed of asphalt mastic. Over the top of each joint, apply a 4-inch wide strip of flexible sheet flashing to both the horizontal and vertical legs.
      b. Install flexible flashing tie-in to air/vapor barrier, extending a minimum of 8 inches up face of wall. Run flexible flashing full width of metal flashing, lapping beyond

metal flashing ends. Run flexible flashing across insulation and metal flashing spanning cavity, and turn down face of lintel 3 inches minimum.

7. At two-piece receiver and counterflashing furnished in Division 07 Section "Sheet Metal Flashing and Trim," install receiver, providing proper weeping and drainage to exterior. Tie in metal flashing to air/water barrier with 12 inch wide cap strip of flexible flashing, adhering 8 inches to air/vapor barrier free of gaps and wrinkles, lapping 4 inches on to metal flashing. Apply continuous bead of termination mastic along cap strip top edge.
8. At base of wall locations where brick shelves is below finish floor elevation, the air/vapor barrier system will be applied to brick shelf as part of air/vapor barrier system specified in Division 07 Section "Fluid Applied Air/Vapor Barrier System." Where brick shelf is flush with or above finish floor elevation, provide metal drip and flexible flashing, tying into air/vapor barrier system as specified above.

C. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
1. Use specified weep/vent products to form weep holes.
2. Space weep holes 24 inches o.c., unless otherwise indicated.
3. Provide weep holes not more than 8 inches from end of lintels.

D. Install vents in head joints in exterior wythes at tops of walls at spacing indicated; if spacing not indicated, space vents 64 inches o.c. Use specified weep/vent products to form vents.

3.9 REINFORCED UNIT MASONRY INSTALLATION

A. Bracing of Walls During Construction: Provide temporary lateral bracing of masonry walls to prevent collapse in accordance with NCMA-TEC 72 and applicable OSHA standards. Contractor is solely responsible for the design and adequacy of bracing methods used.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602 and requirements indicated on Structural Drawings.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Definitions:
   a. Grout Lift: Grout placed in one continuous operation. The maximum time span for grout placement in one lift is 1-1/2 hours measured from time water is added to grout mix. The minimum time span between successive grout lifts is one hour.
   b. Grout Pour: Height of masonry to be grouted prior to erection of additional masonry.
3. Do Not Exceed the Following Pour Heights for Fine Grout:
   a. For minimum widths of grout spaces of 3/4 inch or for minimum grout space of hollow unit cells of 1 1/2 by 2 inches, pour height of 12 inches.
   b. For minimum widths of grout spaces of 2 inches or for minimum grout space of hollow unit cells of 2 by 3 inches, pour height of 60 inches.
   c. For minimum widths of grout spaces of 2-1/2 inches or for minimum grout space of hollow unit cells of 2-1/2 by 3 inches, pour height of 12 feet.
   d. For minimum widths of grout spaces of 3 inches or for minimum grout space of hollow unit cells of 3 by 3 inches, pour height of 24 feet.
4. Do Not Exceed the Following Pour Heights for Coarse Grout:

a. For minimum widths of grout spaces of 1-1/2 inches or for minimum grout space of hollow unit cells of 1-1/2 by 3 inches, pour height of 12 inches.
b. For minimum widths of grout spaces of 2 inches or for minimum grout space of hollow unit cells of 2-1/2 by 3 inches, pour height of 60 inches.
c. For minimum widths of grout spaces of 2-1/2 inches or for minimum grout space of hollow unit cells of 3 by 3 inches, pour height of 12 feet.
d. For minimum widths of grout spaces of 3 inches or for minimum grout space of hollow unit cells of 3 by 4 inches, pour height of 24 feet.

5. Provide cleanout holes at least 3 inches in least dimension for grout pours over 60 inches in height.
   a. Provide cleanout holes at each vertical reinforcing bar.
   b. At solid grouted masonry, provide cleanout holes at not more than 32 inches o.c.
6. Where grouting of cells does not extend full height of wall, install specified grout stop at bottom of lift.
7. Consolidate grout with a mechanical vibrator.
   a. Use a low velocity vibrator with a 3/4- inch head.
   b. Vibrate each cell in concrete masonry units twice. Insert vibrator to bottom of lift and activate for 1 to 2 seconds.
   c. Perform initial consolidation at each cell immediately after grout placement.
   d. Perform reconsolidation in each cell by reinserting vibrator when grout is still plastic.
8. Interior of block cells shall be dry before grouting operations occur to facilitate proper absorption of water from grout. Wet or saturated surface dry conditions are not allowed, and shall be allowed to fully dry before grout placement.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports:
   1. Payment for these services will be made by Owner.
   2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.

B. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

C. Mortar Test (Property Specification): For each mix provided, per ASTM C 780.

D. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.

E. Inspect cores and clean-out holes before grout is placed.

3.11 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Allow mortar to cure above 45 degrees F or greater for minimum 14 days before cleaning. If cure temperature is below 45 degrees F, allow additional time above 45 degrees F to achieve the 14 day cure period to allow the mortar to cure thoroughly.
   2. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   3. Mix cleaner with water at manufacturer's recommended rate. Test cleaning methods on wall at an inconspicuous location.
   4. Protect adjacent non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
   5. Lightly pre-wet wall surfaces with water before applying cleaner.
   6. Clean brick in accordance with manufacturer's printed instructions:
      a. Apply cleaner with low-pressure sprayer and allow to foam and dwell until foam collapses. Reapply cleaner without rinsing until cleaner no longer foams. Do not let cleaner dry on surface.
      b. Pressure wash surface using 25 to 40 degree wide tip nozzle. Use the minimum pressure possible, as determined by the sample test area. Rinse in overlapping pattern, maintaining tip location and pressure in a manner to prevent surface damage to masonry units and mortar joints.
   7. Clean dirty concrete masonry by cleaning method indicated in NCMA TEK 8-4A. Clean stains on concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

E. Protection: Provide final protection and maintain conditions that ensure unit masonry is without damage and deterioration at time of Substantial Completion.

3.12 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Excess Masonry Waste: Remove excess clean masonry waste and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 049000 - CLAY MASONRY RESTORATION AND CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes cleaning of and repointing of exposed exterior face brick.

1.3 DEFINITIONS

A. Low-Pressure Spray: 100 to 300 psi; 4 to 6 gpm.

B. Medium-Pressure Spray: 300 to 600 psi; 4 to 6 gpm.

C. High-Pressure Spray: 600 to 1200 psi; 4 to 6 gpm.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

A. Restoration Specialist Qualifications: Engage an experienced masonry restoration and cleaning firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance.

B. Chemical Manufacturer Qualifications: A firm regularly engaged in producing masonry cleaners that have been used for similar applications with successful results, and with factory-trained representatives who are available for consultation and Project-site inspection and assistance at no additional cost. Obtain all cleaning materials from the same manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.

B. Protect liquid components from freezing. Keep containers tightly closed and away from open flames.

C. Comply with manufacturers' recommendations for minimum and maximum temperature requirements for each product stored.

1.7 PROJECT CONDITIONS

A. Repoint mortar joints only when air temperature is between and 40 and 80 deg F and is predicted to remain so for at least 7 days after completion of work.

B. Clean masonry surfaces only when air temperature is 40 deg F and above and is predicted to remain so for at least 7 days after completion of cleaning.

PART 2 - PRODUCTS

A. Factory-Mixed Pointing Mortar: Pre-blended cementitious mineral based pointing mortar. specifically formulated for mortar joint restoration. Mortar shall contain no acrylics, polymers, or metal constituents.
   1. Product: Jahn M110 JN – Type N Pointing Mortar. No substitution.

2.2 CLEANING MATERIALS

A. Water for Cleaning: Potable; clean, free of oils, acids, alkalis, salts, and organic matter.

B. Chemical Cleaners: Select cleaner as required for field and surface conditions.
   1. Nonacidic Liquid Gel Cleaner: Mildly alkaline liquid gel cleaner
      a. Product: ProSoCo; Enviro Klean EK Restoration Cleaner.
   2. Acidic Cleaner: Acidic masonry restoration cleaner composed of hydrofluoric acid blended with other acids, detergents, wetting agents, and inhibitors.
      a. Product: ProSoCo; Sure Klean Heavy-Duty Restoration Cleaner.

2.3 MORTAR MIXES

A. Measurement and Mixing: Mix materials in a clean, mortar pan mill, by hand in mortar tub. mechanical batch mixer.
   1. Mixing Pointing Mortar: Thoroughly mix prepared factory prepared mortar. cementitious materials and water. Maintain mix ratio between batches to maintain uniform color throughout installation.

B. Do not use admixtures of any kind in mortar, unless otherwise indicated.

2.4 CHEMICAL CLEANING SOLUTIONS

A. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended by chemical cleaner manufacturer, meeting the required concentration as determined by the test panel.

PART 3 - EXECUTION

3.1 PROTECTION

A. Comply with chemical cleaner manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical cleaning solutions from coming into contact with pedestrians, pets, motor vehicles, landscaping, plantings, buildings, and other surfaces that could be harmed by such contact.

1. Do not clean masonry during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
2. Neutralize and collect alkaline and acid wastes for disposal off Owner's property.
3. Dispose of runoff from cleaning operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, plantings, and water penetration into building interiors.

3.2 CLEANING MASONRY - GENERAL

A. Use only those cleaning methods indicated .
   1. Do not use wire brushes or brushes that are not resistant to chemical cleaner being used. Do not use plastic-bristle brushes if natural-fiber brushes will resist chemical cleaner being used.
   2. Use spray equipment that provides controlled application at volume and pressure indicated, measured at spray tip. Adjust pressure and volume to ensure that cleaning methods do not damage masonry. High-pressure spray will not be allowed.
      a. Equip units with pressure gages.
   3. For liquid chemical cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with cone-shaped spray tip. Provide proper methods and protection to prevent damaging drift of air borne spray.
   4. Apply gel cleaners by brush or roller.
   5. For water spray application, use fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees.

B. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces.

C. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to cleaning methods being used. Extraneous substances include paint, calking, asphalt, and tar.
   1. Carefully remove heavy accumulations of material from surface of masonry with a sharp chisel. Do not scratch or chip masonry surface.

D. Water Spray Applications: Unless otherwise indicated, hold spray nozzle at least 6 inches from surface of masonry and apply water in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.

E. Cleaner Application Methods: Apply cleaners to masonry surfaces to comply with manufacturer's written instructions for length of time as determined by the panel test. Scrub surfaces with solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes, as required, to remove soil from mortar joints and crevices. Dip brush in solution often to ensure adequate fresh detergent and that masonry surfaces remain wet. Do not allow chemicals to remain on surface for periods longer than those indicated or recommended by manufacturer.

F. Rinse off chemical residue and soil by working upward from bottom to top of each treated. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.
   1. Apply neutralizing agent and repeat rinse, if necessary, to produce tested pH of between 6.7 and 7.5.

G. After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.

3.3 REPOINTING MASONRY

A. Rake out and repoint mortar joints to the following extent:
   1. All joints in areas indicated.
   2. Joints where mortar is missing or where they contain holes.
   3. Cracked joints where cracks can be penetrated at least 1/4 inch (6 mm) by a knife blade 0.027 inch thick.
   4. Joints where they are deteriorated to point that mortar can be easily removed by hand.

B. Rake out joints as follows:
   1. Remove mortar from joints to depth of 2.5 times joint width, but not less than 1/2 inch. Remove all deteriorated mortar from joints, except do not rake out more than half the width of the masonry unit to prevent compromising of the structural stability of the wall or not less than that required to expose sound, unweathered mortar.
   2. Remove mortar from masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for maximum contact with pointing mortar. Brush, vacuum, or flush joints and clean with filtered compressed air to remove dirt and loose debris.
   3. Do not spall, chip, cut, or damage edges of masonry units or widen joints. Replace or patch damaged masonry units as directed by Architect.
      a. Cut out center of mortar bed joints using angle grinders with diamond-impregnated metal blades. Remove remaining mortar by hand with chisel and mallet. Use small-headed chisels that are no wider than half the width of the existing masonry joints.

C. Point joints as follows:
   1. Rinse masonry-joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen masonry-joint surfaces before pointing. If walls have dried, walls shall be soak with water 10 minutes prior to pointing.
   2. Apply in mortar in one lift, full depth of joint.. Fully compact layer thoroughly.
   3. Where existing bricks have worn or rounded edges, slightly recess finished mortar surface below face of masonry to avoid widened joint faces. Take care not to spread mortar over edges onto exposed masonry surfaces or to featheredge mortar.
   4. Joints shall have surface shape to match existing. When mortar is thumbprint hard, tool joints to match original appearance of joints. Remove excess mortar from edge of joint by brushing.

D. Cure mortar by maintaining in thoroughly damp condition for at least 72 hours including weekends and holidays.
   1. Acceptable curing methods include covering with wet burlap and plastic sheeting, periodic hand misting, and periodic mist spraying using system of pipes, mist heads, and timers.
   2. Adjust curing methods to ensure that pointing mortar is damp throughout its depth without eroding surface mortar.

E. Clean surfaces to remove mortar from face of masonry units. Do not use acidic cleaners on surfaces that have been repointed.

END OF SECTION 049000

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Structural steel.
2. Grout.

1.3 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M.

B. Channels and Angles: ASTM A 36/A 36M.

C. Plate and Bar: ASTM A 36/A 36M.

D. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade B, structural tubing.

E. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.

B. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

1. Nuts: ASTM A 563 (ASTM A 563M) [**heavy-**]hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
4. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

2.3 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.4 GROUT

A. Metallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.

B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Welded

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.7 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A123/A123M.

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.

PART 3 - EXECUTION

3.1 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

C. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

D. Splice members only where indicated.

E. Do not use thermal cutting during erection unless approved by Architect**.**

F. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.2 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.3 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION 051200

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SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Roof deck.
   2. Composite floor deck.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings:
   1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

2.2 ROOF DECK

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. Canam United States; Canam Group Inc.
   2. CMC Joist & Deck.
   3. Consolidated Systems, Inc.; Metal Dek Group.
   4. Epic Metals Corporation.
   5. Nucor Corp.; Vulcraft Group.
   6. Verco Manufacturing Co.
   7. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
   1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), G60 (Z180) zinc coating.
   2. Deck Profile: As indicated.
   3. Profile Depth: As indicated.
   4. Design Uncoated-Steel Thickness: As indicated.
   5. Span Condition: Triple span or more.
   6. Side Laps: Overlapped.

2.3 COMPOSITE FLOOR DECK

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. Canam United States; Canam Group Inc.
   2. CMC Joist & Deck.
   3. Consolidated Systems, Inc.; Metal Dek Group.
   4. Epic Metals Corporation.
   5. Nucor Corp.; Vulcraft Group.
   6. Verco Manufacturing Co.
   7. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
   1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating.
   2. Profile Depth: As indicated.
   3. Design Uncoated-Steel Thickness: As indicated.
   4. Span Condition: Triple span or more.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch (1.52 mm) thick, with factory-punched hole of 3/8-inch (9.5-mm) minimum diameter.

I. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck. For drains, cut holes in the field.

J. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck, with 3-inch- (76-mm-) wide flanges and [level] [sloped] recessed pans of 1-1/2-inch (38-mm) minimum depth. For drains, cut holes in the field.

K. Galvanizing Repair Paint: ASTM A 780.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches (38 mm) long, and as follows:
   1. Weld Diameter: 5/8 inch (16 mm) nominal.
   2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18 inches (457 mm), and as follows:
   1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
   1. End Joints: Lapped 2 inches (51 mm) minimum or butted at Contractor's option.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches (305 mm) apart with at least one fastener at each corner.
   1. Install reinforcing channels or zees in ribs to span between supports and mechanically fasten.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Mechanically fasten to substrate to provide a complete deck installation.
   1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

G. Sound-Absorbing Insulation: Installation into topside ribs of deck as specified in Section 075323 “EPDM Roofing”.

3.4 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
   1. Weld Diameter: 5/8 inch (16 mm), nominal.
   2. Weld Spacing: Space and locate welds as indicated.
   3. Weld Washers: Install weld washers at each weld location at 28 gage form deck.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches (914 mm), and as follows:
   1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
   1. End Joints: Lapped or butted at Contractor's option.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

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SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes, but is not limited to, the following:
   1. Ship's ladders.
   2. Steel framed stairs.
   3. Steel pipe railings, handrails and guardrails.
   4. Catwalk and catwalk framing
   5. Canopies
   6. Loose steel lintels
   7. Loose bearing and leveling plates.
   8. Steel framing and supports for the following:
      a. Roof openings.
      b. Steel framing and supports for mechanical and electrical equipment.
      c. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   9. Miscellaneous fabrications.
   10. Metal bollards.
   11. Rough hardware.

B. Products furnished, but not installed, under this Section include the following:
   1. Loose steel lintels.
   2. Weld plates embedded in CMU walls.

C. Related Sections include the following:
   1. Division 04 Section "Unit Masonry Assemblies" for installing loose lintels, anchor bolts, and other items indicated to be built into unit masonry.
   2. Division 05 Section "Structural Steel."
   3. Division 06 Section "Rough Carpentry" for concealed wood blocking for anchoring railings attached to walls and for metal framing anchors.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance of Railings: Provide railings capable of withstanding the effects of gravity loads, IBC 2009 requirements, and the following loads and stresses within limits and under conditions indicated:
   1. Handrails:
      a. Uniform load of 50 lbf/ ft. applied in any direction.
      b. Concentrated load of 200 lbf applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
   2. Top Rails of Guards:
      a. Uniform load of 50 lbf/ ft. applied in any direction.
      b. Concentrated load of 200 lbf applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
   3. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
b. Uniform load of 25 lbf/ ft. applied horizontally.
c. Infill load and other loads need not be assumed to act concurrently.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For the following:
1. Paint products.
2. Grout.

C. Shop Drawings: Show fabrication and installation details for railings, infill system, guardrails and metal fabrications.
1. Include plans, elevations, sections, and details of railings, infill system, guardrails and metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.
3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Calculations for Railings: Designed and engineered by a qualified professional engineer responsible for their preparation. Submittal shall be signed and stamped by engineer.

E. Welding Certificates: Signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

F. Qualification Data: For professional engineer.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in producing metal fabrications similar to those indicated for this Project with a record of successful in-service performance, and with sufficient production capacity to produce required units without delaying the Work.

B. Professional Engineer Qualifications: Professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for design that are similar to those indicated for this Project in material, design, and extent.

C. Welding: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."
3. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without

field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate installation of steel weld plates and angles for casting into concrete or built into unit masonry that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
   1. Galvanized finish for exterior installations and where indicated.

B. Steel Tubing: Product type (manufacturing method) and as follows:
   1. Cold-Formed Steel Tubing: ASTM A 500.
   2. Hot-Formed Steel Tubing: ASTM A 501.

C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
   1. Black finish, unless otherwise indicated.

D. Malleable-Iron Castings: ASTM A 47, Grade 32510 (ASTM A 47M, Grade 22010).

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, nuts and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.

D. Anchor Bolts: ASTM F 1554, Grade 36.

1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

E. Eyebolts: ASTM A 489.

F. Machine Screws: ASME B18.6.3.

G. Lag Bolts: ASME B18.2.1.

H. Wood Screws: Flat head, ASME B18.6.1.

I. Plain Washers: Round, ASME B18.22.1.

J. Lock Washers: Helical, spring type, ASME B18.21.1.

K. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

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

M. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as required.

N. Chemical Anchors: Two-part epoxy systems with impacted bolt, rod or anchor as follows:
1. Concrete Anchor: Epoxy capsule system similar to Hilti HVA Adhesive Anchor System, Ramset Chemset anchor system, or approved equal.
2. Masonry Anchor: Epoxy injection system similar to Hilti HIT C-100 System.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements of FS TT-P-664, selected for good resistance to normal atmospheric corrosion, compatibility with finish paint system indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
   1. Products:
      a. Sure-grip High Performance Grout; Dayton Superior Corp.
      b. Euco N-S Grout; Euclid Chemical Co.
      c. Five Star Grout; Five Star Products.
      d. Crystex; L & M Construction Chemicals, Inc.
      e. Masterflow 928 and 713; Master Builders Technologies, Inc.
      f. Sealtight 588 Grout; W. R. Meadows, Inc.
      g. Sonogrout 14; Sonneborn Building Products - ChemRex, Inc.

F. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on Shop Drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

F. Weld corners and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

H. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

I. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

J. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
   1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 STEEL PIPE RAILINGS, HANDRAILS AND GUARDRAILS

A. General: Fabricate steel pipe railings and handrails to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
   1. Configuration, Except as Indicated Otherwise: 1-1/4-inch- diameter top and bottom rails and posts, and 1/2-inch- square balusters spaced less than 4 inches clear; 1-1/4-inch-diameter pipe handrails mounted as indicated.
   2. Railings for Ramps: Where indicated, fabricate railings of 1-1/4 inch diameter pipe to configuration indicated.

B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings. All exposed welds shall be ground smooth.

C. Form changes in direction of railings by use of prefabricated elbow fittings and radius bends.

D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

E. Close exposed ends of railing members by welding 3/16-inch thick steel plate in place or by use of prefabricated fittings.

F. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.

G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
   1. Wall Brackets for Pipe Handrails: Fabricate to detail.

H. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

I. Exterior Guardrails: Provide color-galvanized finish for all exterior steel railings and guardrails, including pipe, balusters, bars fittings, fasteners, and other ferrous components.

J. Shop prime interior railings and guard rails.

K. Apply shop primer to uncoated surfaces of railing components, except those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.7 LOOSE STEEL LINTELS

A. Fabricate loose structural steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

B. Weld adjoining members together to form a single unit where indicated.

C. Size loose lintels for equal bearing of 1-inch per foot of clear span but not less than 8-inches bearing at each side of openings, unless otherwise indicated.

D. Galvanize loose steel lintels located in exterior walls.

2.8 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports for applications indicated that are not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

2.9 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
   1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize exterior miscellaneous steel trim.

2.10 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe.
   1. Cap bollards with 1/4-inch- thick steel plate.
   2. Fill bollard with concrete.
   3. Galvanize for exterior locations.

2.11 ROUGH HARDWARE

A. Furnish bent, or otherwise custom-fabricated, bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 06 Sections.

B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts that bear on wood structural connections, and furnish steel washers elsewhere.

2.12 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.13 STEEL AND IRON FINISHES

A. Galvanizing: Provide coating for iron and steel fabrications applied by the hot-dip process, 0.05 - 0.09% nickel content, Duragalv by Duncan Galvanizing, or approved equal. Provide thickness of galvanizing specified in referenced standards. Hot-dip galvanize items as indicated to comply with applicable standard listed below:
   1. ASTM A 123/A 123M, for galvanizing both fabricated and unfabricated steel and iron products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch thick or thicker.
   2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
   3. Galvanizing shall exhibit a rugosity (smoothness) not greater than 4 rug (16-20 microns of variation) when measured by a profilometer over a 1-inch straight line on the surface of architectural and structural elements that are less than 24 pounds per running foot. Profilometer shall be capable of operating in 1 micron increments.
   4. Color-Galvanizing, Exterior Railing Systems and Where Indicated: Colorgalv system by Duncan Galvanizing consisting of galvanizing specified above, coated with plant applied primer and top coat system complying with the following:
      a. Primer: Provide factory-applied polyamide epoxy primer over specially prepared galvanized steel, Primergalv by Duncan Galvanizing. Apply primer within 12 hours after galvanizing at the galvanizer’s plant in a controlled environment meeting applicable environmental regulations, and as recommended by coating manufacturer.
      b. High-Performance Architectural Finish: Provide factory-applied polyurethane color coating, over primed galvanized steel, Colorgalv by Duncan Galvanizing. Apply coating at the galvanizer’s plant, immediately after application of the prime coat, in a controlled environment meeting applicable environmental regulations, and as recommended by coating manufacturer.
      c. Color: As selected by Architect.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
   1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installing anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.2 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.3 INSTALLING RAILINGS AND HANDRAILS

A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
   1. Anchor posts to steel by welding directly to steel supporting members.
   2. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions. Set interior handrails prior to setting of finish materials.

B. Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:
   1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.

2. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
3. For hollow masonry anchorage, use toggle bolts.
4. For steel-framed gypsum board assemblies, use hanger or lag bolts set into concealed wood backing between studs. Coordinate with stud installation to locate backing members.

3.4 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.5 INSTALLING PIPE BOLLARDS

A. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

3.6 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 Section "Painting."

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

D. Color-Galvanized Surfaces: Clean surfaces, repair galvanizing and touch-up to blend with original coating.

END OF SECTION 055000

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOUCMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Framing with dimension lumber.
   2. Wood blocking and nailers.
   3. Plywood backing panels.
   4. Wood trim for fascia boards to be metal clad.

B. Related Sections include the following:
   1. Division 07 Section "Sheet Metal Flashing and Trim" for metal cladding of wood trim.

1.3 DEFINITIONS

A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise indicated.

B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
   1. NELMA - Northeastern Lumber Manufacturers Association.
   2. NLGA - National Lumber Grades Authority.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

C. Evaluation Reports: For the following, showing compliance with ICC-ES:
   1. Power-driven fasteners.
   2. Powder-actuated fasteners.
   3. Expansion anchors.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack plywood and other panels flat. Place spacers between each bundle of lumber, plywood, and panel products to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD AND PANEL PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
   3. Provide dressed lumber, S4S, unless otherwise indicated.
   4. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

B. Wood Structural Panels:
   1. Plywood: DOC PS 1.
   2. Thickness: As needed to comply with requirements specified but not less than thickness indicated.
   3. Factory mark panels according to indicated standard.

2.2 DIMENSION LUMBER FRAMING

A. General: Provide dimension lumber of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.

B. Maximum Moisture Content: 19 percent.

C. Wood Framing: No. 2 or better grade and the following species:
   1. Spruce-pine-fir; NLGA or NeLMA.
   2. Size: As indicated.

2.3 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.

B. For items of dimension lumber size, provide Construction, Stud, or No. 2 or better grade lumber with 19 percent maximum moisture content and the following species:
   1. Spruce-pine-fir; NLGA or NeLMA.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and the following species and grades:
   1. Spruce-pine-fir, Standard or 3 Common grade; NeLMA or NLGA.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

E. Exterior Wood Fascia Boards for Metal Cladding Applications: Kiln-dried, solid lumber with surfaced (smooth) face, Grade No. 3 or better.
   1. Species: Eastern white pine, eastern hemlock-balsam fir-tamarack, eastern spruce, or white woods; NELMA or NLGA.
   2. Size: As indicated.

F. Blocking for Snow Guards: Kiln-dried, solid lumber with surfaced (smooth) face, Construction, Stud, or No. 2 or better.
   1. Species: Spruce-pine-fir; NLGA or NeLMA.
   2. Size: Nominal 2 by 12 inches.

2.4 PLYWOOD BACKING PANELS

A. Telephone, Data, and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch nominal thickness.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
   1. Where rough carpentry is exposed to weather, in ground contact, in roof area, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
   2. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
   3. Where preservative-treated lumber or plywood is used, provide stainless steel fasteners.

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

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

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening Plywood Sheathing to Cold-Formed Metal Framing: Hilti Kwik-Flex or Elco Dril-Flex; 10-24 x 1-1/4" wafer head #3.

F. Lag Bolts: ASME B18.2.1.

G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
   1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
   2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Install framing members of size and spacing indicated.

D. Do not splice structural members between supports, unless otherwise indicated.

E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

F. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

G. Do not use panel materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

H. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.

I. Securely attach rough carpentry and panel work to substrate by anchoring and fastening as indicated, complying with the following:
   1. NES NER-272 for power-driven fasteners.
   2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
   3. National Evaluation Report No. NER-272 for pneumatic or mechanical driven staples, P-Nails, and allied fasteners.

J. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.
   1. Use hot-dip galvanized or stainless steel fasteners where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity.
   2. Use stainless steel fasteners only when fastening to or into pressure preservative treated materials.

K. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

L. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Install wood blocking and nailers to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, casework, window treatment, handrail brackets, shelving, building specialties, window sills, drywall window return shims, countertop supports, and miscellaneous items and fabrications, Owner furnished items, metal flashing, siding and trim support, roof blocking, base flashing backer, and equipment supports, or similar construction. Provide 3/4-inch thick plywood covering a minimum of 32 inches square for toilet accessories. Provide 1-1/2 inch thick blocking minimum, for grab bars and handrail supports. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

1. Install blocking for grab bars and handrail supports to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.
2. Provide concealed wood blocking behind gypsum wallboard where door stops are to be installed.

B. 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. Where possible, secure anchor bolts to formwork before concrete placement.

C. Roofing Nailers: Install wood nailers of same total thickness as insulation. Anchor perimeter nailers to substrate in a manner to resist a force of 200 pounds per linear foot in any direction. Top nailer shall be fastened through the lower layers and into deck.

D. Blocking for Snow Guards: Install 2 x 12 wood blocking, laid flat, between rafters tight to underside of roof sheathing. Ends of blocking shall be nailed through rafter into blocking with a minimum of three 16D nails. Coordinate locations beneath snow guard base plates.

3.3 WOOD STRUCTURAL PANEL INSTALLATION

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

D. Fastening Methods: Fasten panels as indicated below:

1. Sheathing:
   a. Nail to wood framing.
   b. Screw to cold-formed metal framing.
   c. Space panels 1/8 inch apart at edges and ends.
2. Plywood Backing Panels: Screw to supports.

END OF SECTION 061000

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SECTION 064000 - ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes, but is not limited to, the following:

1. Plastic-laminate countertops.

B. Related Sections include the following:
1. Division 06 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.

C. General: Submit in accordance with Division 01 Section "Submittal Procedures."

D. Product Data: For each type of product indicated and finishing materials and processes.

E. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for plumbing fixtures, grommets, and other items installed in countertops.

F. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.
1. Thermoset decorative overlays.

G. Product Certificates: Signed by manufacturers of woodwork certifying that products furnished and construction provided comply with requirements.

H. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

I. Coordinate locations and sizes of plumbing fixtures that will penetrate countertops.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Products: Comply with the following:
   1. Hardboard: AHA A135.4.
   2. Medium-Density Fiberboard, MDF: ANSI A208.2, Grade MD-21, 48 lb. density.
   3. Particleboard: ANSI A208.1, Grade M-2.
   4. Softwood Plywood: DOC PS 1, Medium Density Overlay.
   5. Hardwood Plywood and Face Veneers: HPVA HP-1, Grade A veneers.
      a. Veneer Core Construction, All Locations Except as Noted: Veneer core plywood, no voids.
         1) 3/4-Inch Thickness: 7 plies.
         2) 1/2-Inch Thickness: 5 plies.

C. Thermoset Decorative Overlay: Particleboard complying with ANSI A208.1, Grade M-2, or medium-density fiberboard complying with ANSI A208.2, Grade MD, with surface of thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1, fused to core using average pressure of 320 psi and average temperature of 320 deg F.

D. High-Pressure Decorative Laminate, PL1, PL2: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.
   1. Manufacturer: Pionite; a division of Pioneer Plastics Corp.
   2. Colors, Patterns, and Finishes: As indicated on Materials Legend.

E. Edgebanding for Plastic Laminate: Rigid PVC extrusions, through color with satin finish, 1 mm and 3 mm thick, with radiused edges. Hot melt adhesive application.

2.2 COUNTERTOP ACCESSORY MATERIALS

A. Counter Bracket Supports: Fabricated of 6063 T-6, T-shaped extruded aluminum; MIG welded along 45 degree miters and along back; pre-punched for 1/4-inch fasteners; provide rubber grommet in 7/8-inch hole; powder coated finish. Provide bracket for flush mounted installation.
   1. Product: Rakks Counter Support Brackets, EH Series; Rangine Corp., Millis, MA.

2.3 INSTALLATION MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

B. Screws: Select material, type, size, and finish required for each use and substrate. Comply with ASME B 18.6.1 for applicable requirements.
   1. For metal framing supports, provide screw as recommended by metal-framing manufacturer.

C. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

D. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

E. VOC Limits for Installation Adhesives and Glues: Installation adhesives and glues used inside the weatherproofing system shall have the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1. Wood Glues: 30 g/L.
   2. Contact Adhesive: 250 g/L.

2.4 FABRICATION, GENERAL

A. Interior Woodwork Grade: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade indicated and any additional requirements of this Section. When quality grade is not indicated, provide Custom quality grade.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
   1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

D. Shop cut openings, to maximum extent possible, to receive hardware, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
   1. Seal edges of openings in countertops with a coat of water-resistant varnish.

2.5 PLASTIC-LAMINATE COUNTERTOPS

A. Quality Standard: Comply with AWI Section 400C requirements for high-pressure decorative laminate countertops.

B. Grade: Custom.

C. High-Pressure Decorative Laminate Grade: HGS.

D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
   1. Match color, pattern, and finish as indicated by manufacturer's designations for these characteristics.

E. Edge Treatment: Same as laminate cladding on horizontal surfaces.

F. Core Material: Particleboard.

G. Countertops, Plastic Laminate: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
   1. Align adjacent solid-surfacing countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
   2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
   3. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
   4. Install countertop brackets specified in Part 2. Painting of bracket specified in Division 09 Section "Painting."
   5. Caulk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."

END OF SECTION 064000

SECTION 070150 - PREPARATION FOR RE-ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Roof tear-off.
   2. Removal of base flashings.

B. Related Sections:
   1. Section 075323 - Ethylene-Propylene-Diene-Monomer (EPDM) Roofing for new roof system.

1.3 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

1.4 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

B. Existing Membrane Roofing System: Roofing membrane, roof insulation, flashing, and components and accessories between deck and roofing membrane.

C. Roof Tear-Off: Removal of existing membrane roofing system, down to bare deck.

D. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and reinstalled.

E. Existing to Remain: Existing items of construction that are not indicated to be removed.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning membrane roofing removal. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Reroofing Conference: Conduct conference at Project site .
   1. Meet with Owner; Architect; roofing system manufacturer's representative; rough carpentry installer; roofing Installer including project manager, superintendent, and foreman; and installers whose work interfaces with or affects reroofing including installers of roof accessories and roof-mounted equipment.

2. Review methods and procedures related to roofing system tear-off and replacement including, but not limited to, the following:
    a. Reroofing preparation, including membrane roofing system manufacturer's written instructions.
    b. Coordination protection of existing construction during installation of roof blocking and metal fascia at roof eaves and gables, and roof blocking and anchoring for the attachment of snow guards.
    c. Construction schedule and availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
    d. Condition and acceptance of existing roof deck and base flashing substrate for reuse.
    e. Structural loading limitations of deck during reroofing.
    f. Base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that will affect reroofing.
    g. HVAC shutdown and sealing of air intakes, if permitted.
    h. Existing conditions that may require notification of Architect before proceeding.

1.6 PROJECT CONDITIONS

A. Owner will occupy portions of building immediately below reroofing area. Conduct reroofing so Owner's operations will not be disrupted. Provide Owner with not less than 72 hours' notice of activities that may affect Owner's operations.
    1. Coordinate work activities daily with Owner.

B. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.

C. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.

D. Conditions existing at time of inspection for bidding will be maintained by Owner as far as practical.

E. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering existing roofing system or building.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate with Owner to shut down air-intake equipment in the vicinity of the Work if permitted. Cover air-intake louvers before proceeding with reroofing work that could affect indoor air quality.

B. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.

C. Verify that rooftop utilities and service piping have been shut off before beginning the Work.

3.2 ROOF TEAR-OFF

A. General: Notify Owner each day of extent of roof tear-off proposed for that day.

B. Roof Tear-Off: Remove existing roofing membrane and other membrane roofing system components down to the deck.
   1. Remove roof insulation and underlayment.
   2. Scrape existing roof decks to remove roof system down to roof deck.
   3. Remove fasteners from deck surface.

3.3 DECK PREPARATION

A. Inspect deck after tear-off of membrane roofing system.

B. If deck surface is not suitable for receiving new roofing or if structural integrity of deck is suspect, immediately notify Architect. Do not proceed with installation until directed by Architect.

C. Sweep roof deck clean, free of dust, dirt and debris.

3.4 EXISTING BASE FLASHINGS

A. Remove existing base flashings around curbs, walls, and penetrations.
   1. Clean substrates of contaminants such as asphalt, sheet materials, dirt, and debris.

B. Do not damage metal counterflashings that are to remain. Replace metal counterflashings damaged during removal with counterflashings specified in Section 076200 "Sheet Metal Flashing and Trim."

3.5 DISPOSAL

A. Collect demolished materials and place in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
   1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
   2. Storage or sale of demolished items or materials on-site is not permitted.

B. Transport and legally dispose of demolished materials off Owner's property.

END OF SECTION 070150

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SECTION 072110 - SPRAY-IN-PLACE RIGID URETHANE FOAM INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes spray polyurethane foam insulation.

B. Related Sections include the following:
1. Division 07 Section "Building Insulation."
2. Division0 9 Section "Gypsum Board Assemblies" for provision in metal-framed assemblies of interior acoustical insulation.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product indicated.
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers with labels indicating manufacturer, product name and designation, and directions for storing and mixing with components.

B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes. Store materials covered, out of direct sunlight, and at temperatures between 60 deg F and 70 deg F.

C. Dispose of empty containers by technicians in accordance with manufacturer's recommendations, current law, and industry standard practice.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply material when ambient or substrate temperature is 50 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application. Do not apply material when moisture due to dew, frost or water is present on substrate materials.

PART 2 - PRODUCTS

2.1 SPRAY POLYURETHANE FOAM INSULATION

A. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
   1. Density: ASTM D 1622; minimum density of 2.0 lb/cu. ft.
   2. Thermal Resistivity (R-Factor), LTTR: Not less than 5.4 per inch of thickness.
   3. Closed Cell Content: ASTM D 2856, 90 percent minimum.
   4. Vapor Permeance: ASTM E 96, 1-inch thickness, 1.2 perms maximum.
   5. Applied Thickness: Apply to provide a cured thickness of not less than indicated.
   6. Locations: Walls indicated.
   7. Products:
      a. Corbond III Performance Insulation System; Corbond Corporation, Bozeman, MT.
      b. Heatlok Soy; Demilec LLC, Arlington, TX.

PART 3 - EXECUTION

3.1 PREPARATION

A. Mask and cover windows, doors, electrical boxes, existing materials and substrates, and other items not indicated to receive insulation, protecting from fallout or overspray of materials during application.

B. Brush down masonry wall, roof deck, adjacent roof framing, and substrates to loosen and remove cobwebs, dirt, dust and debris. Upon completion of brush-down, blow surfaces clean with compressed air to remove remaining surface dust and dirt. Upon completion of operations, substrate shall be clean of substances that are harmful to insulation or that interfere with insulation attachment.

3.2 INSTALLATION OF SPRAY POLYURETHANE FOAM INSULATION

A. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Apply in consecutive passes as recommended by the manufacturer to achieve specified thickness.

B. Apply insulation to seal voids at interface of top of walls and roof deck.

C. To the maximum extent possible, apply insulation as uniformly and smooth as possible.

3.3 CLEANING

A. Cleaning: Remove material overspray, and protection materials from surfaces of other construction and clean exposed surfaces. Remove trash and debris from the project site and properly dispose of.

END OF SECTION 072110

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SECTION 074213 - METAL COMPOSITE MATERIAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Metal-faced composite wall panels.
   2. Manufactured moldings for panel installations.
   3. Prefinished aluminum trim and flashing in conjunction with panels.
   4. Sealant for panel joints and panel to adjacent construction materials.

B. Related Sections:
   1. Division 06 Section "Rough Carpentry" for structural wood panels supporting metal-faced composite wall panels.
   2. Division 07 Section "Sheet Metal Flashing and Trim" for field-formed flashings and other sheet metal work not part of metal-faced composite wall panel assemblies.
   3. Division 07 Section "Joint Sealants" for field-applied sealants not otherwise specified in this Section.

1.3 DEFINITION

A. Metal-Faced Composite Wall Panel Assembly: Metal-faced composite wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weathertight wall system.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Metal-faced composite wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of wall area when tested according to ASTM E 283 at the following test-pressure difference:
   1. Test-Pressure Difference: 1.57 lbf/sq. ft..

C. Water Penetration Under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
   1. Test-Pressure Difference: 6.24 lbf/sq. ft..

D. Structural Performance: Provide metal-faced composite wall panel assemblies capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:
   1. Wind Loads: Determine loads based on the following minimum design wind pressures:
      a. Uniform pressure as indicated on Drawings.
   2. Deflection Limits: Metal-faced composite wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/175 of the span at the perimeter and 1/60 of the span anywhere in the panel.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.5 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal-faced composite wall panel and accessory.

C. Shop Drawings: Show fabrication and installation layouts of metal-faced composite wall panels; details of edge and corner conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish among factory-, shop-, and field-assembled work.
   1. Accessories: Include details of anchorage systems, flashing and trim, at a scale of not less than 3 inches per 12 inches.
   2. Location of backer reinforcement to receive cast aluminum letters signage.

D. Samples for Initial Selection: For each type of metal-faced composite wall panel indicated with factory-applied color finishes.
   1. Include similar Samples of trim and accessories involving color selection.
   2. Include manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view.

E. Qualification Data: For Installer and fabricator.

F. Warranties: Samples of special warranties.

1.6 QUALITY ASSURANCE

A. Fabricator/Installer Qualification: Shall be certified by metal-faced composite wall panel manufacturer to fabricate and install manufacturer's wall panel system and shall employ workers trained and approved by manufacturer.

B. Source Limitations: Obtain all metal-faced composite wall panels from single source from single manufacturer.

C. Preinstallation Conference: Conduct conference at Project site.
   1. Meet with Owner, Architect, metal-faced composite wall panel Installer, and installers whose work interfaces with or affects metal-faced composite wall panels including weather barrier installer, metal trim and flashing, and aluminum framed storefront assemblies.
   2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review methods and procedures related to metal-faced composite wall panel installation, including manufacturer's written instructions.
   4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural panels.
   5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal-faced composite wall panels.

6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal-faced composite wall panel assembly during and after installation.
8. Review wall panel observation and repair procedures after metal-faced composite wall panel installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.
10. Provide 5 business days minimum advance notice to participants prior to convening preinstallation conference.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal-faced composite wall panels, and other manufactured items so as not to be damaged or deformed. Package metal-faced composite wall panels for protection during transportation and handling. Provide markings to identify components consistent with Shop Drawings.

B. Unload, store, and erect metal-faced composite wall panels in a manner to prevent bending, warping, twisting, and surface damage. Cover fork truck tines and use protected rigging lifting devices to protect panels from marring and damage.

C. Store metal-faced composite wall panels vertically, covered with suitable weathertight and ventilated covering. Store metal-faced composite wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal-faced composite wall panels in contact with other materials that might cause staining, denting, or other surface damage. Do not allow storage space to exceed 120 deg F.

D. Protect strippable protective covering on metal-faced composite wall panels from exposure to sunlight and high humidity, except to extent necessary for period of metal-faced composite wall panel installation. Retain strippable protective covering on metal-faced composite wall panel for period of panel installation.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal-faced composite wall panels to be performed according to manufacturer's written instructions and warranty requirements.

B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal-faced composite wall panel fabrication and indicate measurements on Shop Drawings.

1.9 COORDINATION

A. Coordinate metal-faced composite wall panel assemblies with flashing, trim and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

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

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal-faced composite wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: Manufacturer's standard; not less than 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

A. Aluminum Sheet: Coil-coated sheet, ASTM B 209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
   1. Surface: Smooth, flat finish.
   2. Exposed Coil-Coated Finishes:
      a. Two-Coat Fluoropolymer: AAMA 620 or AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Coating shall comply with physical properties and coating performance requirements of AAMA 2605, except as modified below:
         1) Humidity Resistance: 2000 hours.
         2) Salt-Spray Resistance: 2000 hours.
   3. Exposed Color: Shall match Bone White color of sheet metal flashing and trim.
   4. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

B. Panel Sealants:
   1. Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, nonstaining, nonbleeding, nonstreaking, weatherproofing silicone sealant; two part with compression capability up to 50 percent of the original joint width without affecting adhesion; 20 year warranty.
      a. Sealant Color: Shall match adjacent panel color.
      b. Product: 756 Silicone Building Sealant HP; Dow Corning.
   2. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

2.2 MISCELLANEOUS MATERIALS

A. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and finish indicated.

B. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal-faced composite wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

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

2.3 METAL-FACED COMPOSITE WALL PANELS

A. General: Provide factory-formed and -assembled, metal-faced composite wall panels fabricated from two metal facings bonded, using no glues or adhesives, to solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment system components and accessories required for weathertight system.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Alcan Composites USA Inc.; Alucobond.
      b. Alcoa Inc.; Reynobond PE.
      c. ALPOLIC, Division of Mitsubishi Chemical America, Inc.; ALPOLIC.
      d. Firestone Metal Products, LLC; UNA-FAB Series 1000UC.

B. Aluminum-Faced Composite Wall Panels (7F - Metal Siding): Formed with 0.020-inch- thick, coil-coated aluminum sheet facings.
   1. Panel Thickness: 0.236 inch.
   2. Core: Standard.
   3. Exterior Finish: 2-coat fluoropolymer.
      a. Color: Shall match Bone White color of sheet metal flashing and trim.

C. System Type: Route and return system; system shall provide a wet seal (caulked) reveal joint as detailed on Drawings.
   1. System shall not generally have any visible fasteners, telegraphing or fastening on panel faces or any other compromise of a neat, flat appearance.

D. Attachment System Components: Formed from extruded aluminum.
   1. Include manufacturer's standard panel clips and anchor system.

2.4 ACCESSORIES

A. Wall Panel Accessories: Provide components required for a complete metal-faced composite wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal-faced composite wall panels unless otherwise indicated.

B. Flashing and Trim: Fabricate from 0.032 inch minimum thickness aluminum sheet with same finish, and color as facings of adjacent composite panels, unless otherwise indicated. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, framed openings, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal-faced composite wall panels.

2.5 FABRICATION

A. General: Fabricate and finish metal-faced composite wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional requirements.

B. Fabricate metal-faced composite wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.

C. Metal-Faced Composite Wall Panels: Factory form panels in a continuous process with no glues or adhesives between dissimilar materials. Trim and square edges of sheets with no displacement of face sheets or protrusion of core material.
   1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.
   2. Fabricate panels with sharply cut edges, with no displacement of face sheets or protrusion of core material.
   3. Dimensional Tolerances:
      a. Panel Bow: 0.8 percent maximum of panel length or width.
      b. Squareness: 0.25 inch maximum.
      c. Length: Plus 0.375 inch.
      d. Width: Plus 0.188 inch.
      e. Thickness: Plus or minus 0.008 inch.
   4. Reinforce panels and provide backer material not less than 3/4-inch thick plywood to receive attachment of cast aluminum lettering.

D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" and the recommendations of the composite wall panel manufacturer that apply to design, dimensions, metal, and other characteristics of item indicated.
   1. Flashing and trim shall be fabricated in 8 to 10 foot lengths.
   2. Hem edges of all metal accessories, concealing raw edges and back of sheets.
   3. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   4. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.
   5. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
   6. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
   7. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal-faced composite wall panel manufacturer.
      a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal-faced composite wall panel manufacturer for application, but not less than thickness of metal being secured.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal-faced composite wall panel supports, and other conditions affecting performance of the Work.
   1. Examine wall framing to verify that studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal-faced composite wall panel manufacturer.
   2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal-faced composite wall panel manufacturer.
   3. Verify that weather barrier has been installed over sheathing.

B. Examine roughing-in for components and systems penetrating metal-faced composite wall panels to verify actual locations of penetrations relative to seam locations of panels before panel installation.

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

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

3.2 METAL-FACED COMPOSITE WALL PANEL INSTALLATION

A. General: Install metal-faced composite wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Shim or otherwise plumb substrates receiving metal-faced composite wall panels.
   2. Flash and seal metal-faced composite wall panels at perimeter of all openings. Do not begin installation until weather barrier and flashings that will be concealed by panels are installed.
   3. Install flashing and trim as metal-faced composite wall panel work proceeds.
   4. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
   5. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.

B. Fasteners: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior. Exposed fasteners shall be finished to match adjacent panel finish.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal-faced composite wall panel manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal-faced composite wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by panel manufacturer.
   1. Prepare joints and apply sealants to comply with installation requirements in Division 07 Section "Joint Sealants."

E. Attachment System Installation, General: Install attachment system required to support metal-faced composite wall panels and to provide a complete weathertight wall system, including perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
   1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
   2. Do not begin installation until weather barrier and flashings that will be concealed by composite panels are installed.

F. Clip Installation for Wet Route and Return System: Attach panel clips to supports at each metal-faced composite wall panel joint at locations, spacings, and with fasteners recommended by manufacturer. Attach routed-and-returned flanges of wall panels to panel clips with manufacturer's standard fasteners.
   1. Seal horizontal and vertical joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant according to installation requirements specified in Division 07 Section "Joint Sealants."

3.3 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal-faced composite wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual," and approved Shop Drawings. Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
   1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
   3. Exposed fasteners shall match color and finish of material being secured.

3.4 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal-faced composite wall panel units within installed tolerance of 1/4 inch in 20 feet, nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as metal-faced composite wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal-faced composite wall panel installation, clean finished surfaces as recommended by panel manufacturer. Maintain in a clean condition during construction.

B. After metal-faced composite wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal-faced composite wall panels that have been damaged.

END OF SECTION 074213

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SECTION 075323 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Adhered EPDM membrane roofing system.
2. Roof insulation related to EPDM membrane roofing.
3. Roof accessories.
4. Manufactured roof edge strip.

B. Related Sections:
1. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Division 07 Section "Preparation for Re-Roofing" for removal and disposal of existing roofing and flashings.
3. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
4. Division 07 Section "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
5. Division 22 Sections for roof drains.

1.3 DEFINITIONS

A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

B. Thermal Resistivity: Where the thermal resistivity of insulation products are designated by "r-values," they represent the reciprocal of thermal conductivity (k-values). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivities are expressed by the temperature difference in degrees F between the two exposed faces required to cause one BTU to flow through one square foot per hour at mean temperatures indicated.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
   1. Corner Uplift Pressure: 40 lbf/sq. ft.
   2. Perimeter Uplift Pressure: 40 lbf/sq. ft.
   3. Field-of-Roof Uplift Pressure: 20 lbf/sq. ft.

D. SPRI Wind Design Standard for Manufactured Roof Edge Strip Flashings: Manufacture and install roof-edge flashings tested according to SPRI ES-1 and capable of resisting the following design wind uplift pressures:
   1. Corner Uplift Pressure: 40 lbf/sq. ft.
   2. Perimeter Uplift Pressure: 40 lbf/sq. ft.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Provide installation instructions and general recommendations from manufacturer of EPDM membrane system for types of roofing materials required.
   1. Manufactured Roof Edge Strip: Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and installation instructions. Provide proof of compliance with SPRI ES-1.

B. Shop Drawings: For roofing system approved by the manufacturer. Include plans, elevations, sections, details, and attachments to other work. Customized detail sheets shall be prepared by manufacturer, showing each condition and approved installation method conforming with construction drawing constraints and details.
   1. Base flashings and membrane terminations.
   2. Layout of tapered insulation, including slopes.
   3. Roof plan showing orientation of steel roof deck and orientation of membrane roofing and fastening spacings and patterns for mechanically fastened membrane roofing.
   4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
   5. Roof flashing details shall be consistent with those shown on Drawings. Where cap flashing is shown, a standard manufacturer's bar anchor only detail is not acceptable. Membrane manufacturer's recommended flashing detail may be considered by the Architect when no detail is provided.

C. Samples for Verification: For the following products, in manufacturer's standard sizes:
   1. Blank sample of manufacturer's warranty forms.
   2. Manufactured Roof Edge Strip: 12 inches long. Include fasteners and other exposed accessories. Provide with selected finish and color.

1.6 INFORMATIONAL SUBMITTALS

A. Installer Qualification Data: For qualified Installer signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

B. Manufacturer Certificate: Signed by roofing manufacturer certifying that membrane roofing system complies with requirements specified in "Performance Requirements" Article.
   1. Submit evidence of complying with performance requirements.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified, independent testing agency, for components of membrane roofing system.
   1. Include insulation test reports evidencing compliance with specified requirements including those for thermal resistance, fire-test-response characteristics, water-vapor transmission, water absorption, and other properties, based on comprehensive testing of current products.

D. Research/Evaluation Reports: For components of membrane roofing system, from the ICC-ES.

E. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

F. Test data for pullout resistance of insulation fastening system.

G. Warranties: Sample of special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For membrane roofing system to include in maintenance manuals.

B. Warranties: Special warranties specified in this Section.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is factory trained and licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty. Contractor shall have a minimum of 5 years experience installing the system, have installed a minimum of 500,000 square feet and shall employ personnel experienced and skilled in the application of the manufacturer's roofing system.
   1. Work associated with membrane roofing including, but not limited to, insulation, flashing, and membrane sheet joint sealers, shall be performed by Installer of this Work.

B. Source Limitations: Obtain components including roof insulation and fasteners for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.
   1. Insulation shall be by or approved by roofing manufacturer for use with roofing system for a total system warranty.

C. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

D. Insulation Fire Performance Characteristics: Provide insulation and related materials with the fire-test-response characteristics specified elsewhere in this Section as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
   1. Surface Burning Characteristic: ASTM E 84.
   2. Fire Resistance Ratings: ASTME E 119.
   3. Combustion Characteristics: ASTM E 136.

E. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

F. Pull Test: Conduct 20 pull test for testing insulation fasteners to existing wood decks. Test shall comply with ANSI/SPRI FX-1 Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners.

G. Roofing work shall be applied in strict accordance with the provisions of the specification criteria. No deviations shall be permitted without written consent from the Architect. Should a conflict between this specification and the manufacturer's requirements arise, the most restrictive provision as determined by the Architect shall govern.

H. Inspection Report: Upon completion of the installation, an inspection shall be made by the roofing system manufacturer to ascertain that the roofing system has been installed according to applicable manufacturer's specifications and details. No "early bird" warranty will be accepted. Results of the warranty inspection shall be submitted in writing to Owner and Architect for their review and records.

I. Preinstallation Roofing Conference: Conduct conference at Project site. Review methods and procedures related to roofing system including, but not limited to, the following:
   1. Meet with Owner, Architect, testing representative, roofing Installer, roofing system manufacturer's representative, and installers whose work interfaces with or affects roofing.
   2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
   3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
   5. Review structural loading limitations of roof deck during and after roofing.
   6. Review closure cap at peak of roof where ridge vent is removed.
   7. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
   8. Review governing regulations and requirements for insurance and certificates if applicable.
   9. Review construction schedule to minimize construction activities on completed roofing.
   10. Review temporary protection requirements for roofing system during and after installation.
      a. Review staging, material placement, construction activity and pedestrian traffic protection requirements for work areas and access paths to areas where work will occur on completed roofing.
   11. Review roof observation and repair procedures after roofing installation. Establish monitoring procedures for construction activities and recording of damage by sub-trades.
   12. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.
   13. Provide 5 business days minimum advance notice to participants prior to convening preinstallation conference.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, shelf life, approval or listing agency markings, and directions for storing and mixing with other components. Comply with manufacturer's written instructions for proper material storage.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
   1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life. Replace discarded materials at no additional cost to Owner.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
   1. Insulation and cover board shall be stored on pallets, not less than 4 inches off ground, tightly covered with waterproof, "breathable" materials. Protect insulation from direct sunlight.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.
   1. Do not overload any portion of building, either by use of or placement of equipment, storage of debris, or storage of materials. Construction loads shall not exceed 25 pounds per square foot.

E. Materials shall be delivered in sufficient quantity to allow continuity of Work.

F. Materials, which are damaged, shall be removed and replaced at Installer's expense.

G. Manufactured Roof Edge Strip: Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling. Do not store metal flashing and trim in contact with other materials that might cause staining, denting, or other surface damage.

1.10 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
   1. Weather protection shall mean the temporary protection of that work adversely affected by moisture, wind, heat, and cold by covering, patching and sealing, enclosing, ventilation, cooling and/or heat.

B. Proceed with work so roofing materials are not subject to construction traffic. When construction traffic is necessary, roof sections shall be protected with plywood or other appropriate material to prevent damage; remove protection after construction traffic has ceased and re-inspected for possible damage.

C. Substrate Conditions: Do not begin roofing installation until substrates have been inspected and are determined to be in satisfactory condition. All surfaces shall be smooth, dry, clean, free of fins or sharp edges, loose or foreign materials, oil or grease. No work shall proceed when moisture is present on roof or in substrate materials.

D. Temporary Waterstops: Install at end of each workday and remove before proceeding with next day's work.

E. Protect against fire and flame spread. Maintain proper and adequate fire extinguishers.

F. If exterior walls are not erected at time of membrane installation, envelop flutes of metal deck to prevent moisture intrusion and wind damage.

G. Coordinate shut down or covering of air-handling ducts whenever possible during roofing activities to prevent fumes from adhesives from entering the building. The covering or shut-down of air-handling ducts shall be approved by the Owner prior to starting the work.
   1. See Section 015000 - Temporary Facilities and Controls for additional requirements.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks. The maximum wind speed coverage shall be peak gusts of 72 mph measured at 10 meters above ground level. Warrantor shall be the manufacturer of the roofing membrane. Warranty shall be written to building Owner.
   1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, roofing accessories, and other components of membrane roofing system.
   2. Warranty shall include manufacturer's standard puncture warranty.
   3. Warranty Period: 30 years from date of Substantial Completion.

B. When the Warrantor is notified that there is a problem (leak or damage) with warranted roofing system and/or accessories by telephone, and/or in writing (fax, e-mail or mail), the response time to physically start repairs shall be within twenty-four hours from time of telephone or date of written notification.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 EPDM MEMBRANE ROOFING

A. EPDM: ASTM D 4637, Type I, non-reinforced, uniform, flexible EPDM sheet.
   1. Manufacturers:
      a. Carlisle SynTec Incorporated.
      b. Firestone Building Products.
      c. Versico Incorporated.
   2. Thickness: 90 mils, nominal.
   3. Exposed Face Color: Black.

2.3 AUXILIARY MEMBRANE ROOFING MATERIALS

A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
   1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
   2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
      a. Plastic Foam Adhesives: 50 g/L.
      b. Multipurpose Construction Adhesives: 70 g/L.
      c. Single-Ply Roof Membrane Adhesives: 250 g/L.
      d. Single-Ply Roof Membrane Sealants: 450 g/L.
      e. Nonmembrane Roof Sealants: 300 g/L.
      f. Sealant Primers for Nonporous Substrates: 250 g/L.
      g. Sealant Primers for Porous Substrates: 775 g/L.
      h. Other Adhesives and Sealants: 250 g/L.

B. Sheet Flashing: 60-mil- thick EPDM, partially cured or cured, according to application.

C. Bonding Adhesive: Manufacturer's standard, water based capable of withstanding Project wind uplift requirements.

D. Seaming Material: Manufacturer's standard splice tape for sealing lapped joints, including edge sealer to cover exposed spliced edges as recommended by membrane manufacturer.

E. Lap Sealant: Manufacturer's standard, single-component sealant.

F. Membrane Adhesive: As recommended by membrane manufacturer for particular substrate and project conditions, formulated to withstand specified uplift force.

G. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

H. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

I. Crickets and Flashing Accessories: Types recommended by membrane manufacturer, including adhesive tapes, flashing cements, and sealants.
   1. Crickets: Tapered crickets, extending to roof drain sumps, 1/2-inch taper.

J. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to roofing system manufacturer.
   1. Fasteners into pressure preservative treated materials shall be stainless steel.

K. Miscellaneous Accessories: Provide preformed cone flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.
   1. Pourable sealers not allowed.
   2. Field-formed pipe flashing not allowed.

2.4 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by EPDM membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, 20 psi, glass-fiber mat facer on both major surfaces.
   1. Insulation LTTR-Values: Not less than R-5.6 per inch.
   2. Thickness: 1 layer of 2-1/2 inch thick insulation, unless otherwise indicated.
   3. Products:
      a. Carlisle SynTec Inc.; Polyiso HP-H.
      b. Dow Chemical Co.; Hy-Therm AP.
      c. Firestone Building Products Co.; ISO 95+.
      d. Johns Manville International, Inc.; E'nrg'y 3.
   4. Provide roofing manufacturer's required insulation for total system warranty.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches, unless otherwise indicated.
   1. Tapered insulation shall meet requirements specified for board roof insulation. Provide tapered boards where indicated.
   2. Tapered insulation at roof drains shall slope 1/2 inch per 12 inches, unless otherwise indicated.
   3. Tapered insulation shall be manufactured by same manufacturer of board roof insulation.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.5 INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

C. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch thick, factory primed.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Georgia-Pacific Corporation; Dens Deck Prime.

D. Manufactured Roof Edge Strip: Manufactured two-piece, roof-edge strip consisting of fascia cover with drip edge fabricated to shape indicated in section lengths not exceeding 12 feet**,** and a continuous formed 22 gage galvanized cleat with drip to engage fascia hook; and necessary splice plates.
   1. Performance: Per IBC 2009, 1504.5, low-slope membrane roof system metal edge securement shall be designed and installed for wind loads and tested in accordance with ANSI/SPRI ES-1.
   2. Exposed Flashing Material: Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality, 24 gauge (0.0276 inch) coated metal thickness.

a. Finish: Fluoropolymer 2-Coat Coating System, manufacturer's standard 2-coat, thermocured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements of AAMA 2605.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
   1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
   2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

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

3.2 PREPARATION

A. General: Comply with manufacturer's instructions for preparing substrate to receive EPDM membrane roof system.

B. See Division 07 Section "Preparation for Re-Roofing" for removal and disposal of existing roofing and flashings.

C. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

D. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 INSULATION AND COVER BOARD INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated, or if not indicated, as required for positive drainage.

D. Install insulation in single layer under area of roofing at required thickness.

E. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
   1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

F. Install cover board over insulation with joints staggered from joints of insulation layer a minimum of 12 inches in each direction with no gaps.

G. Mechanically Fastened Insulation and Cover Board: Install insulation and cover board and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
   1. Fasten to resist uplift pressure at corners, perimeter, and field of roof as determined in accordance with ASCE 7, but in no case, provide less than one anchor per 4 sq. ft. of surface area (8 fasteners per 4 x 8 foot board).
      a. In no case shall there be less than 2 fasteners per piece of insulation and cover board.
   2. Screws shall be installed utilizing automatic, positive clutch disengaged and adjustable nosepiece.
   3. Tapered insulation shall be mechanically attached using same procedures noted above.
   4. Install tapered edge strips at edges of tapered insulation to provide smooth transition to flat areas, free of gaps and voids.

H. Do not install more insulation in a day than can be covered with membrane before end of day or before start of inclement weather.

3.4 ADHERED MEMBRANE ROOFING INSTALLATION

A. Adhere membrane roofing over area to receive roofing according to membrane roofing system manufacturer's written instructions and approved Shop Drawings. Unroll membrane roofing without stretching and allow to relax before installing.

B. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.

C. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.

E. In addition to adhering, mechanically fasten membrane roofing securely into wood blocking, at terminations, penetrations, and perimeters as required by roof conditions.

F. Apply membrane roofing with side laps shingled with slope of roof deck.

G. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.

H. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

I. Perimeter membrane shall extend down wall at least 1 inch past bottom of the wood nailer, lapping over the wall finish, but not exposed below the flashing.

J. Flashing details shall be done in accordance with the approved Shop Drawings. Base flashing shall be properly terminated and covered with counterflashing, providing not less than a 4-inch overlap.

K. Cut out and repair membrane defects at the end of each day's work.

3.5 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions and approved Shop Drawings.

B. Flashing of parapets, curbs, expansion joints, and other parts of the roof shall be performed using EPDM membrane flashing.

C. At parapets and roof edges, flashing shall run under metal coping and flashing full length and width. Membrane shall extend down wall at least 1-inch past bottom of wood nailer, lapping over wall finish, but not exposed below the flashing.

D. Flash all projections including pipes, conduits, and curbs passing through the membrane.
   1. Flash pipes and conduits with pre-molded cone type flashing boots. Do not field fabricate pipe flashing.

E. Base Flashing: Tops of elastomeric base flashing shall be secured with a continuous aluminum termination bar, sealed and counterflashed.

F. All vertical flashings and membranes shall be adhered to substrates regardless of height.

G. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.

H. Flash penetrations and field-formed inside and outside corners with sheet flashing conforming to manufacturer's requirements. Provide a minimum overlap of 3-inches.

I. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

J. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.6 INSTALLATION OF MANUFACTURED ROOF EDGE TRIM/FASCIA

A. General: Install manufactured roof edge strips and accessories according to manufacturer's written instructions. Anchor with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements. Use fasteners, separators, sealants, and other miscellaneous items as required to complete manufactured roof edge systems.
   1. Install manufactured roof edge strips with provisions for thermal and structural movement.

B. Install manufactured roof edge strips level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.

C. Install manufactured roof edge to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.

D. Seal joints with elastomeric sealant as required by manufacturer of roofing specialties.

3.7 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
   1. Notify Architect or Owner 72 hours in advance of date and time of inspection.

B. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
   1. Coordinate staging, material placement, construction activity and pedestrian traffic protection requirements for work areas and access paths to areas where work will occur on completed roofing.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075323

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following sheet metal flashing and trim:
   1. Manufactured through-wall flashing.
   2. Manufactured reglets.
   3. Manufactured roof edge trim/fascia units.
   4. Formed counterflashing and base flashing.
   5. Metal cladding for wood trim.
   6. Formed wall flashing and trim.
   7. Miscellaneous sheet metal accessories.

B. Related Sections include the following:
   1. Division 04 Section "Unit Masonry Assemblies" for installing receiver flashing, reglets, and other sheet metal flashing and trim.
   2. Division 06 Section "Rough Carpentry" for wood nailers and blocking.
   3. Division 07 Section "Metal Wall Panels" for factory-formed composite wall panels and flashing and trim not part of sheet metal flashing and trim.
   4. Division 07 Section " Ethylene-Propylene-Diene-Monomer (EPDM) Roofing" for manufactured roof edge strip complying with ES-1 and installing custom formed sheet metal flashing and trim integral with roofing membrane.

1.3 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

C. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and installation instructions.

C. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Provide layouts at 1/4-inch scale and details at 3-inch scale. Include the following:
   1. Identify material, thickness, weight, and finish for each item and location in Project.
   2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
   3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
   4. Include details of termination points and assemblies.
   5. Include details of roof-penetration flashing.
   6. Details of flashings, counter flashings, step flashing, and miscellaneous fabrications as applicable.
   7. Details of connections to adjoining work.

D. Samples for Verification: Sample of Bone White finish to ensure match with manufactured roof edge and soffit panels.

E. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed sheet metal flashing and trim work similar in material, design, forming method, and extent to that indicated for this Project and with a record of successful in-service performance for ten years.

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual, Seventh Edition." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
   1. Copper Standard: Comply with CDA's "Copper in Architecture Handbook" and "Copper & Common Sense" published by Revere Copper Products, Inc.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
   1. Meet with Owner, Architect, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories.
   2. Review methods and procedures related to sheet metal flashing and trim.
   3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
   4. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.
   5. Provide not less than 5 business days advance notice to participants prior to convening preinstallation conference.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, staining, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
   1. Store tin-zinc alloy coated copper away from uncured concrete and masonry.

D. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.7 COORDINATION

A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

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

1.8 WARRANTY

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

B. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 30 years from date of Substantial Completion.

C. Special Installer's Warranty: Installer's warranty, on warranty form at end of this Section, signed by Installer, in which Installer agrees to repair or replace components of custom-fabricated sheet metal flashing and trim that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.
      b. Loose parts.
      c. Wrinkling or buckling.
      d. Failure to remain weathertight, including uncontrolled water leakage.
   2. Warranty Period: Two years for date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 SHEET METALS

A. Tin-Zinc Alloy Coated Copper: ASTM B 370, Temper H00, cold-rolled copper sheet, of minimum 16 oz. uncoated weight (thickness), coated both sides with a zinc-tin alloy (50 percent zinc, 50 percent tin), total weight (thickness) of 17.2 oz/sq. ft..
   1. Product: FreedomGray, Revere Copper Products, Inc.

B. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   1. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; structural quality.
   2. Exposed Finishes: Apply the following coil coating:
      a. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
         1) Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements of AAMA 2605, except as modified below:
            a) Humidity Resistance: 2000 hours.
            b) Salt-Spray Resistance: 2000 hours.
         2) Colors: Atas International, Inc.; Bone White (26).

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
   1. Nails for Tin-Zinc Alloy Coated Copper Sheet: Copper or hardware bronze, 0.109 inch minimum and not less than 7/8 inch long, barbed with large head.
   2. Exposed Fasteners for Prefinished Metal Flashings: Stainless steel, heads matching color of sheet metal by means of plastic caps or factory-applied coating.
   3. Fasteners for Prefinished Flashing and Trim: Stainless steel, blind fasteners or self-drilling screws, gasketed, with hex washer head.
   4. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
   5. Fasteners into Preservative Treated Lumber: Stainless steel.

C. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

F. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

G. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage as required for performance.
   1. Cleats: Mechanically seamed cleats formed from same metal and gage as sheet metal flashing and trim.

H. Elastic Flashing Filler: Closed cell polyethylene or other soft closed cell material recommended by elastic flashing manufacturer as fill under flashing loops to ensure movement with minimum stress on flashing sheet.

2.4 MANUFACTURED ROOF EDGE FLASHINGS

A. Roof Edge Fascia (Strip): Two-piece, roof edge fascia (strip) consisting of snap-on metal fascia cover, in section lengths not exceeding 12 feet with concealed splice plates and a continuous formed galvanized steel sheet cant dam, 0.028 inch thick, 24 gage, minimum, with integral drip edge cleat to engage fascia cover. Provide matching factory-mitered and welded corner units, spillout type scupper unit, and fascia extender with offset.
   1. Products:
      a. MM Systems Corporation; F-Series.
      b. W. P. Hickman Company; Econosnap 2, Model EC2-850.
      c. Metal-Era, Inc.; Perma-Tite System 200, Model FA-80.
   2. Fascia Cover Material: Prefinished, aluminum-zinc alloy-coated sheet steel, not less than 0.028 inch thick, 24 gage.
   3. Color: As indicated on Exterior Elevation Materials Legend.
   4. Accessories: Provide overflow scuppers with perforated screen. Scuppers shall be all welded construction and shall match color of roof edge fascia.

2.5 CUSTOM FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual, Seventh Edition" and referenced copper standards that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Fabricate sheet metal flashing and trim in minimum 96-inch- lengths, but not exceeding 10-foot- long sections.

D. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
   1. Seams: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

E. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with recommendations in SMACNA and referenced copper standards.

F. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

G. Separations: Provide for separation of metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or other permanent separation as recommended by manufacturer/fabricator.

H. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

I. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
   1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual, Seventh Edition," referenced copper standards, -and-FMG Loss Prevention Data Sheet 1-49 for application but not less than thickness of metal being secured.

2.6 CUSTOM FABRICATED FLASHING SCHEDULE

A. Two-Piece Counter Flashing for Membrane Flashing at Masonry Veneer Cavity Wall: SMACNA, Figure 4.4C (modified); turn vertical leg up 8 inches; make horizontal leg run back to wall sheathing; 12-inch wide Z-shaped cover plates for receiver joints, 16 oz. tin-zinc alloy coated copper receiver; 16 oz. tin-zinc alloy coated copper insert flashing. Furnish receiver flashing and cover plates to mason for installation into brickwork. Provide mason with joint cover plate sealing requirements to make permanently watertight.

B. Two-Piece Counter Flashing for Membrane Flashing at Masonry Veneer Solid Wall, No Cavity: SMACNA, Figure 4.4C (modified); 12-inch wide Z-shaped cover plates for receiver joints, 16 oz. tin-zinc alloy coated copper receiver; 16 oz. tin-zinc alloy coated copper insert flashing. Receiver held in place with lead wedges, joint sealed with continuous exposed joint sealant complying with Section 079200.

C. Two-Piece Stepped Counter Flashing for Membrane Flashing at Masonry Veneer Cavity Wall: Fabricate receiver flashing and counter flashing to detail indicated on drawings. 16 oz. tin-zinc alloy coated copper receiver; 16 oz. tin-zinc alloy coated copper insert flashing.

D. Two-Piece Counter Flashing for Membrane Flashing at Metal Siding: SMACNA, Figure 4.4C (modified); turn vertical leg up 8 inches; 12-inch wide Z-shaped cover plates for receiver joints. Fabricated from prefinished, aluminum-zinc alloy-coated sheet steel, minimum 24 gage thickness for receiver and insert flashing; color as selected by Architect. Furnish receiver flashing and joint cover plates to siding installer for installation into siding work. Provide siding installer with joint cover plate sealing requirements to make permanently watertight.

E. Metal Cladding for Wood Trim: Bend metal with metal break to clad wood trim; fabricated from prefinished, aluminum-zinc alloy-coated sheet steel, not less than 24 gage.

F. Miscellaneous Flashing at Masonry: Formed to detail; not less than 16 oz. tin-zinc alloy coated copper.

2.7 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
   1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

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

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   1. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
   1. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
   2. Bed flanges in thick coat of water cutoff mastic where required for waterproof performance.

C. Install sheet metal flashing and trim with minimum number of joints practical, using manufactured or shop fabricated full-length pieces. Provide one piece flashing and trim using full-length pieces without joints where run is less than the 8 to 10 foot fabricated lengths. Do not use pieces less than 24 inches long.

1. Sill Flashing at Openings: Provide one piece flashing, full width of opening except where opening exceeds available manufactured/fabricated lengths. Provide sealed metal end dams at ends of sills. Sills flashing shall turn up on back side to form pan, directing water to the exterior.

D. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

E. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

F. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
1. Cleats shall be continuous, unless otherwise noted.

G. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

H. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
1. Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
2. Copper: Use copper fasteners.

I. Seal joints with elastomeric sealant as required for watertight construction.
1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with installation requirements in Division 07 Section "Joint Sealants."

3.3 CUSTOM FABRICATED FLASHING AND TRIM INSTALLATION

A. General: Except as otherwise indicated, install sheet metal flashing and trim comply with fabricator’s installation instructions, performance requirements, and SMACNA "Architectural Sheet Metal Manual, Seventh Edition." Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible; and set units true to line and level as indicated. All edge strips shall be neatly folded; external and internal corners shall be mitered and soldered for copper, and sealed in full bed of water cut off mastic for pre-finished metal. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.
1. Fabricate in minimum 96-inch- long sections, but not exceeding 10-foot-long sections.

B. Back-Up and Cover Plates: Where specified, set flashing ends in full bed of water cut-off mastic, allowing 1/4-inch between sections.

C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend

counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric sealant.

1. Install receivers to receive counterflashing in manner and by methods indicated.
    a. Where receivers are shown in masonry, provide them to mason for installation as specified in Division 04 Section "Unit Masonry Assemblies."
    b. Where receivers are shown in metal siding, provide them to installer of siding for installation as specified in Division 07 Section 074213 "Metal Wall Panels."
2. Secure in a waterproof manner by means of snap-in installation or wedging in-place. Fill reglets with elastomeric sealant, as indicated and depending on degree of sealant exposure.
3. Verify correct installation of receiver flashing with cover plates properly set and sealed at joints for two-piece counter flashing detail.
    a. At receivers set in masonry, coordinate the sealing of the cover plate joints with butyl flashing tape, in addition to bedding in mastic.

D. Install flashing and sheet metal trim with concealed fasteners, unless indicated otherwise. Metal flashing and trim shall be installed to resist wind blow-off and prevent flutter and vibration. Allow for expansion and contraction, making square, straight corners and tight overlaps, free of gaps and openings, properly sealed to be watertight.

E. Electrolytic Action: Where two dissimilar metals adjoin or lap each other (example: galvanized metal ducts and copper cap flashing), an approved separating strip or other insulating material shall be installed.

F. Bed flanges of work in water cut off mastic where required for waterproof performance.

3.4 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.5 INSTALLER'S WARRANTY

A. WHEREAS <**Insert name**> of <**Insert address**>, herein called the "Installer," has performed siding, roofing, flashing and associated work ("work") on the following project:

1. Owner: <**Insert name of Owner.**>
2. Address: <**Insert address.**>
3. Building Name/Type: <**Insert information.**>
4. Address: <**Insert address.**>
5. Area of Work: <**Insert information.**>
6. Acceptance Date: <**Insert date.**>
7. Warranty Period: <**Insert time.**>
8. Expiration Date: <**Insert date.**>

B. AND WHEREAS Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
    a. lightning;
    b. peak gust wind speed exceeding 70 mph.
    c. fire;
    d. failure of siding and roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
    e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
    f. vapor condensation on bottom of work; and
    g. activity on work by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Installer to perform said alterations, Warranty shall not become null and void unless Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of siding, roofing, flashing, or trim failure. Specifically, this Warranty shall not operate to relieve Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this <Insert day> day of <Insert month>, <Insert year>.

1. Authorized Signature: <**Insert signature.**>
2. Name: <**Insert name.**>
3. Title: <**Insert title.**>

END OF SECTION 076200

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SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Roof hatch safety railing system.

B. Related Sections:
   1. Division 05 Section "Metal Fabrications" for metal vertical ladders for access to roof hatches.
   2. Division 07 Section "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, and miscellaneous sheet metal trim and accessories and for manufactured fasciae and copings.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include manufacturer's detailed technical product data; installation instructions and recommendations; and construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.6 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 METAL MATERIALS

A. Aluminum Sheet: ASTM B 209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
   1. Mill Finish: As manufactured.
   2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

B. Aluminum Extrusions and Tubes: ASTM B 221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used, otherwise mill finished.

C. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.

D. Steel Tube: ASTM A 500, round tube.

E. Galvanized-Steel Tube: ASTM A 500, round tube, hot-dip galvanized according to ASTM A 123/A 123M.

F. Steel Pipe: ASTM A 53/A 53M, galvanized.

2.2 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Polyisocyanurate Board Insulation: ASTM C 1289, thickness as indicated.

C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
   1. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
   2. Fasteners into Preservative-Treated Lumber: Series 300 stainless steel.

F. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

G. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

2.3 ROOF HATCH

A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, and integrally formed deck-mounting flange at perimeter bottom.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Model L-50T manufactured by The Bilco Company or comparable product by one of the following:
      a. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
      b. Nystrom.

B. Type and Size: Single-leaf lid, 30 by 96 inches.

C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.

D. Hatch Material: Aluminum sheet, 0.090 inch thick.
   1. Finish: Mill.

E. Construction:
   1. Insulation: Polyisocyanurate board, 2 inches thick, for both lid and curb. Insulation shall be fully covered and protected by an interior liner panel.
   2. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
   3. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
   4. Fabricate curbs to minimum height of 12 inches, unless otherwise indicated.

F. Hardware: Galvanized -steel spring latch with turn handles, both inside and exterior, stainless steel butt- or pintle-type hinge system, and padlock hasps inside and outside.

G. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements, OSHA strength requirements with a safety factor of two, and authorities having jurisdiction.
   1. Height: 42 inches above finished roof deck.
   2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
   3. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches in diameter.
   4. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard non0corrosive hinges and self-latching mechanism.
   5. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
   6. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
   7. Fabricate joints exposed to weather to be watertight.
   8. Fasteners: Manufacturer's standard, finished to match railing system.
   9. Finish: Manufacturer's standard.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

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

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions and recommendations. Coordinate installation of roof accessories with installation of roof deck, roof insulation, flashing, roofing membranes, penetrations, equipment, and other construction involving roof accessories to ensure that each element of the Work performs properly.
   1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
   2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
   3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
   4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
   1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, or ferrous metal.

C. Roof-Hatch Installation:
   1. Install roof hatch so top surface of hatch curb is level.
   2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
   3. Attach safety railing system to roof-hatch curb.

D. Seal joints with elastomeric sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

B. Clean off excess sealants.

C. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

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SECTION 078413 - THROUGH-PENETRATION FIRESTOP SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Penetrations in fire-resistance-rated walls.
   2. Penetrations in horizontal assemblies.
   3. Penetrations in smoke barriers.
   4. Permanent labels at each firestop location.

B. Related Sections:
   1. Division 07 Section "Fire-Resistive Joint Systems" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.
   2. Division 07 Section "Joint Sealants" for non-fire-resistive joint sealants.
   3. Division 09 Section "Gypsum Board Assemblies" for firestopping where fire rated gypsum board assemblies butt adjacent construction including beams, floors, roofs and structural members.
   4. Division 22 and 23 Sections specifying duct and piping penetrations, including fire-suppression piping.
   5. Division Sections specifying cable and conduit penetrations.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product indicated. Include installation instructions.

C. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction, and kind of penetrating item. Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition required.
   1. Submit documentation, including illustrations applicable to each through-penetration firestop system configuration for construction and penetrating items.
   2. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
   3. For those firestop applications that exist for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from a similar UL system design or other tests shall be submitted to local authorities having jurisdiction for their review and approval prior to installation. Manufacturer's engineering judgement shall follow requirements set forth by the International Firestop Council.

D. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.
   1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

E. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified, independent testing agency, for penetration firestopping.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that required for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.

C. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
   1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
      a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
      b. Classification markings on penetration firestopping correspond to designations listed by the following:
         1) UL in its "Fire Resistance Directory."
         2) Intertek ETL SEMKO in its "Directory of Listed Building Products."
         3) FM Global in its "Building Materials Approval Guide."

D. Provide through-penetration firestop system products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, subpart F, Appendix A, Section 1, "Polarized Light Microscopy."

E. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and

inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.

B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate Work of this Section with the work of other trades to assure the proper sequencing of each installation and to provide a fire- and smoke-resistant installation.

B. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

C. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

D. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

E. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by Owner's inspecting agency and building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. A/D Fire Protection Systems Inc.
2. Grace Construction Products.
3. Hilti, Inc.
4. Johns Manville.
5. Nelson Firestop Products.
6. NUCO Inc.
7. Passive Fire Protection Partners.
8. RectorSeal Corporation.
9. Specified Technologies Inc.
10. 3M Fire Protection Products.
11. Tremco, Inc.; Tremco Fire Protection Systems Group.
12. USG Corporation.

2.2 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements required, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
   1. Provide paintable through-penetration firestop products at locations exposed to view, except at mechanical, electrical and elevator machine rooms.

B. 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.
   1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barrier walls and fire partitions.
   2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. 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.
   1. Horizontal assemblies include ceiling membranes of roof/ceiling assemblies.
   2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
   3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
   1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.

E. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
   1. Permanent forming/damming/backing materials, including the following:
      a. Slag-wool-fiber or rock-wool-fiber 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.
   2. Temporary forming materials.
   3. Substrate primers.
   4. Collars.
   5. Steel sleeves.

2.3 FILL MATERIALS

A. 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.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening 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 nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. 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, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application required.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
   1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
   2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

C. Install fill materials for firestopping by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing and inspecting agency, UL system number and date.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Owner may engage a qualified testing agency to perform tests and inspections.

B. Allow for 3 random samples of each type of firestopping system to be inspected. Reinstall disturbed samples to comply with requirements.

C. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.
   1. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

D. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

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SECTION 078446 - FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Joints in or between fire-resistance-rated constructions.

B. Related Sections:
   1. Division 07 Section "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.
   2. Division 07 Section "Joint Sealants" for non-fire-resistive joint sealants.
   3. Division 07 Section "Expansion Control" for fire-resistive architectural joint systems.
   4. Division 09 Section "Gypsum Board Assemblies" for firestopping where fire rated gypsum board assemblies butting adjacent construction including masonry, steel deck, joists, beams, floors, roofs and structural members.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product proposed for use. List product characteristics, typical uses, performance and limitation criteria, test data, and installation instructions.

B. Shop Drawings: For each fire-resistive joint system, show each kind of construction condition in which joints are installed; also show relationships to adjoining construction. Include fire-resistive joint system design designation of testing and inspecting agency acceptable to authorities having jurisdiction that demonstrates compliance with requirements for each condition indicated.
   1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-resistive joint system configuration for construction and penetrating items.
   2. For those firestop applications that exist for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from a similar UL system design or other tests shall be submitted to local authorities having jurisdiction for their review and approval prior to installation. Manufacturer's engineering judgment shall follow requirements set forth by the International Firestop Council.

C. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing fire-resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Installation Responsibility: Assign installation of penetration firestopping systems and fire-resistive joint systems in Project to a single qualified installer.

C. Source Limitations: Obtain fire-resistive joint systems, for each kind of joint and construction condition indicated, through one source from a single manufacturer.

D. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:
   1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Fire-resistive joint systems are identical to those tested per testing standard indicated. Provide rated systems complying with the following requirements:
      a. Fire-resistive joint system products bear classification marking of qualified testing agency.
      b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:
         1) UL in its "Fire Resistance Directory."
         2) Intertek ETL SEMKO in its "Directory of Listed Building Products."

E. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

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

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

C. Notify Owner's testing agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on day preceding each series of installations.

D. Do not cover up fire-resistive joint system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector of authorities having jurisdiction have examined each installation.

PART 2 - PRODUCTS

2.1 FIRE-RESISTIVE JOINT SYSTEMS

A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:
   1. Joints include those installed in or between fire-resistance-rated walls, floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies.
   2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
      a. For fire-resistance joint systems with movement capabilities, allow for the following movement:
         1) Floors: 1/2-inch deflection.
         2) Roofs: 1 1/2-inch deflection.
   3. Provide systems with L-rating where walls and partitions also are smoke barriers. Where a fire-resistive joint system is not available with the ability to resist smoke, provide smoke sealant material to one side of wall to stop the passage of smoke.
   4. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. A/D Fire Protection Systems Inc.
      b. CEMCO.
      c. Fire Trak Corp.
      d. Grace Construction Products.
      e. Hilti, Inc.
      f. Johns Manville.
      g. Nelson Firestop Products.
      h. NUCO Inc.
      i. Passive Fire Protection Partners.
      j. RectorSeal Corporation.

k. Specified Technologies Inc.
l. 3M Fire Protection Products.
m. Tremco, Inc.; Tremco Fire Protection Systems Group.
n. USG Corporation.

C. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
1. For fire-resistive joint systems exposed to view in public spaces upon completion of Work, provide products that are paintable.
a. Mechanical, electrical and elevator machine rooms are not considered public spaces.

D. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems submitted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications submitted.

B. Install forming materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
   1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
   2. Apply fill materials so they contact and adhere to substrates formed by joints.
   3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels will be visible to anyone seeking to remove or penetrate joint system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Fire-Resistive Joint System - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner may engage a qualified testing agency to perform tests and inspections.

B. Before installation of ceilings and adjacent construction that would conceal firestopping, inspect joints to verify complete installation of firestopping materials.

C. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.

D. Additional inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and substrate manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION 078446

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:
   1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:
      a. Construction and control joints in cast-in-place concrete.
      b. Control and expansion joints in unit masonry.
      c. Joints between metal panels.
      d. Joints between different materials listed above.
      e. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
      f. Other joints as indicated.
   2. Exterior joints in the following horizontal traffic surfaces:
      a. Isolation and contraction joints in cast-in-place concrete slabs.
      b. Other joints as indicated.
   3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
      a. Control and expansion joints on exposed interior surfaces of exterior walls.
      b. Perimeter joints of exterior openings where indicated.
      c. Tile control and expansion joints.
      d. Vertical joints on exposed surfaces of interior unit masonry walls and partitions.
      e. Perimeter joints between interior wall surfaces and frames of interior doors, windows, borrowed lites, and elevator entrances.
      f. Joints between plumbing fixtures and adjoining walls, floors, and counters.
      g. Other joints as indicated.
   4. Interior joints in the following horizontal traffic surfaces:
      a. Isolation and control joints in exposed cast-in-place concrete slabs.
      b. Other joints as indicated.

B. Related Sections include the following:
   1. Division 04 Section "Unit Masonry Assemblies" for masonry control and expansion joint fillers and gaskets.
   2. Division 07 Section "Sheet Metal Flashing and Trim" for sealing joints related to flashing and sheet metal for roofing.
   3. Division 07 Section "Through-Penetration Firestop Systems" for sealing penetrations in fire-resistance-rated construction.
   4. Division 07 Section "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
   5. Division 08 Section "Glazing" for glazing sealants.
   6. Division 09 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
   7. Divisions 22, 23, and 26 for sealing of perimeter joints of plumbing, HVAC systems, automatic fire protection systems, telecommunication systems, and electrical systems.
   8. Division 32 Sections for sealing joints in pavements, walkways, and curbing.

1.3 PERFORMANCE REQUIREMENTS

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

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

1.4 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

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

C. Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint design, including width and depth of joint sealant, and backer rod or bond-breaker size and location.
   3. Joint-sealant manufacturer and product name.
   4. Joint-sealant formulation.
   5. Joint-sealant color.
   6. Primer for each substrate type.
   7. Solvent wipe cleaner for each substrate type.
   8. For sealants and sealant primers used inside the weatherproofing system, including printed statement of VOC content.

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

E. Field-Adhesion Test Reports: For each sealant test.

1.5 QUALITY ASSURANCE

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

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

1.6 DELIVERY, STORAGE, AND HANDLING

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

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

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

1.7 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

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

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

1.8 SEQUENCING AND SCHEDULING

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

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
   1. Architectural Sealants: 250 g/L.
   2. Sealant Primers for Nonporous Substrates: 250 g/L.
   3. Sealant Primers for Porous Substrates: 775 g/L.

C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

D. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

E. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

F. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range and custom colors. Allow for 3 custom colors to be used on the project.

2.2 JOINT SEALANTS

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

B. Type 2 - General Purpose Exterior Sealant: Single-component, nonsag, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, for Use NT. Shall be no staining on granite, precast concrete and brick per ASTM C 1248.
   1. Dow Corning Corporation; 795.
   2. GE Advanced Materials - Silicones; SilPruf NB SCS9000.
   3. Pecora Corporation; 864NST.
   4. Tremco Incorporated; Spectrem 3.

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

D. Type 4 - Plumbing Fixture/Tile Sealant: Silicone; ASTM C920, Uses M and A; single component, mildew resistant, color selected by Architect.
   1. 898 Silicone; Pecora Corporation.
   2. Tremsil 200 Sanitary; Tremco, Inc.

E. Type 5 - Interior Floor Joint Sealant: Polyurethane, self-leveling; ASTM C920, Grade P, Class 25, Uses T, M and A; single component.
   1. Sonolastic SL-1; Sonneborn, Division of ChemRex Inc.
   2. Tremflex S/L; Tremco.
   3. Sikaflex-1CSL; Sika Corporation, Inc.
   4. NR-201; Pecora Corporation.
   5. Vulkem 45; Tremco.
   6. Chem-Calk 950; Bostik Findley.

F. Acoustical Sealant: See Division 09 Section "Gypsum Board Assemblies."

2.3 JOINT-SEALANT BACKING

A. General: Provide sealant backings (backer rods) of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Plastic Foam Joint Fillers (Backer Rods): ASTME C 1330, Type C, preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
   1. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.4 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   2. Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
   3. Remove laitance and form-release agents from concrete.
   4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates, where indicated or recommended in writing by joint-sealant manufacturer, based on prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
   1. Masonry and concrete surface shall be primed.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Installation of Sealant Backings (Backer Rods): Install sealant backings to comply with the following requirements:
   1. Install sealant backings of type indicated to provide support of sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
      a. Do not leave gaps between ends of sealant backings.
      b. Do not stretch, twist, puncture, or tear sealant backings.
   2. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and joint fillers or backs of joints.

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

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without

deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

B. JOINT-SEALANT SCHEDULE

C. Control, Expansion, and Soft Joints in Masonry and Between Masonry and Adjacent Work: Type 2; colors as selected. Prime masonry.

D. Exterior Joints Between Precast Concrete Units and Adjacent Construction: Type 2; colors as selected. Prime precast concrete.

E. Joints between Exterior Metal Frames and Adjacent Work (except masonry): Type 2; colors as selected.

F. Under Exterior Door Thresholds: Type 1.

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

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

I. Exposed Interior Perimeter Joints of Exterior Openings: Type 3; colors as selected.

J. Control and Expansion Joints in Interior Concrete Slabs and Floors Left Exposed: Type 5; colors as selected.

K. Joints between Plumbing Fixtures and Walls and Floors and Between Countertops and Walls: Type 4; colors as selected.

L. Interior Joints for Which No Other Sealant is Indicated: Type 3; colors as selected.

END OF SECTION 079200

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SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Hollow metal doors and frames.

B. Related Sections:
   1. Division 04 Section "Unit Masonry Assemblies" for embedding anchors for hollow metal work into masonry construction.
   2. Division 08 Section "Door Hardware" for door hardware for hollow metal doors.
   3. Division 08 Section "Glazing" for glazed lites in steel doors and borrow lites.
   4. Division 09 Sections "Painting" for field painting hollow metal doors and frames.

1.3 DEFINITIONS

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

B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."
   1. Submittals for Division 08 Sections "Hollow Metal Doors and Frames" and "Door Hardware" shall be made concurrently.

B. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, and finishes.

C. Shop Drawings: Include the following:
   1. Elevations of each door design.
   2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses. Provide dimensions for proper edge clearances of wood and metal doors, including meeting stiles for pairs of doors going into metal frames.
   4. Locations of reinforcement and preparations for hardware.
   5. Details and locations of smoke seals and weather stripping gaskets of frames.
   6. Details of each different wall opening condition.
   7. Details of anchorages, joints, field splices, and connections.
   8. Details of accessories.
   9. Details of moldings, removable stops, and glazing.
   10. Details of conduit and preparations for power, signal, and control systems.

D. Door Schedule: Provide a schedule of hollow metal doors and frames prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule and aluminum frames.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

F. Certificate: Provide certification that primed non-galvanized steel doors comply with ANSI A250.10 acceptance criteria and primer has a uniform dry film thickness of not less than 0.7 mils.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C (Positive pressure).
   1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

C. Door Frame Inspection: Contractor with Installer shall inspect each door frame, checking frame for squareness, alignment, twist, and plumbness before installation of wallboard and masonry to assure proper fit of doors with correct clearances and operation without modification to the door. Frames that are out of tolerance shall be reinstalled to requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

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

C. Inspect doors and frames on delivery for damage; notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.

D. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- high wood blocking. Do not store in a manner that traps excess humidity.
   1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 COORDINATION

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

2.2 MATERIALS

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

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

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

G. Grout: Comply with Division 04 Section "Unit Masonry Assemblies."

H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

I. Glazing: Comply with requirements in Division 08 Section "Glazing."

J. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 HOLLOW METAL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8, unless more stringent requirements are specified.
   1. Design: Flush panel.
   2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core. Provide internal sound deadener on inside of face sheets.
      a. Fire Door Core: As required to provide fire-protection ratings indicated.
      b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 11.1 deg F x h x sq. ft./Btu when tested according to ASTM C 518, unless otherwise indicated.
         1) Locations: Exterior doors.
   3. Vertical Edges for Doors: Beveled edge.
      a. Beveled Edge: 1/8 inch in 2 inches.
   4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick, end closures or channels of same material as face sheets.
   5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
   1. Level 3 and Physical Performance Level A (Extra Heavy Duty) (16 Gage), Model 2 (Seamless).

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet, unless metallic-coated sheet is indicated. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
   1. Level 3 and Physical Performance Level A (Extra Heavy Duty), 16 Gage, Model 2 (Seamless).

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates of sufficient strength from same material as door face sheets to support hardware without through bolting and to comply with the following minimum sizes:
   1. Hinges: Minimum 0.123 inch thick, 10 gage, by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
   2. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 0.067 inch thick, 8 gage.
   3. All Other Surface-Mounted Hardware: Minimum 0.067 inch thick, 8 gage.

E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Coordinate hardware for hollow metal doors mounted in aluminum frames with hardware preparation of frames in Division 08 Section "Aluminum-Framed Entrances and Storefronts."

2.4 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.

B. Exterior Frames: Fabricated from metallic-coated steel sheet.
   1. Fabricate frames with mitered or coped corners and seamless face joints.
   2. Fabricate frames as full profile welded unless otherwise indicated.
   3. Frames for Level 3 Steel Doors: 0.053-inch- thick, 16 gage, steel sheet.

C. Interior Frames: Fabricated from cold-rolled steel sheet.
   1. Fabricate frames with mitered or coped corners and seamless face joints.
   2. Fabricate frames as face welded, unless otherwise indicated.
   3. Frames for Level 3 Steel Doors: 0.053-inch- thick, 16 gage, steel sheet.
   4. Frames for Wood Doors: 0.053-inch- thick, 16 gage, steel sheet.
   5. Frames for Borrowed Lights: 0.053-inch- thick, 16 gage, steel sheet.
   6. All welded joints shall be ground and dressed to be smooth, flush, and invisible.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates of sufficient strength from same material as frames to support hardware without through bolting and to comply with the following minimum sizes:
   1. Hinges: Minimum 0.123 inch thick, 10 gage, by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
   2. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 0.067 inch thick, 14 gage.
   3. All Other Surface-Mounted Hardware: Minimum 0.067 inch thick, 14 gage.
   4. Fabricate concealed stiffeners and hardware reinforcement plates from same material as frames.
   5. Locate hardware reinforcement plates as indicated on Shop Drawings or, if not indicated, according to ANSI/SDI A250.6.

E. Plaster Guards: Formed from same material as frames, not less than 0.016-inch thick, 28 gage, steel sheet to close off interior of openings; place at back of hardware cutouts where mortar or other materials might obstruct hardware operation.

2.5 FRAME ANCHORS

A. Jamb Anchors:
   1. Masonry Type: T-shaped anchors to suit frame size, not less than 0.042 inch thick, 18 gage.
   2. Stud-Wall Type: Slip in wood stud anchor; not less than 0.053 inch thick, 16 gage.
   3. Postinstalled Expansion Type for Existing In-Place Concrete or Masonry: Minimum 3/8-inch- diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, 18 gage, and as follows:
   1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.6 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, 22 gage, fabricated from same material as door face sheet in which they are installed.
   1. Provide non-removable stops on outside of exterior doors and on secure side of interior doors for glass in doors.
   2. Provide screw-applied, removable, glazing stops on inside of glass in doors.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, 22 gage, fabricated from same material as frames in which they are installed.

2.7 ACCESSORIES

A. Mullions, Corner Mullions and Transom Bars: Join to adjacent members by welding.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

2.8 FABRICATION

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

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Doors:
1. Exterior Doors: For exterior locations and elsewhere as indicated, fabricate doors from metallic-coated steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 0.053-inch- thick, 16 gage, metallic-coated steel channels with channel webs placed even with top and bottom edges. Seal joints in top edges of doors against water penetration.
2. Interior Door Faces: Fabricate exposed faces of doors, including stiles and rails of nonflush units, from cold-rolled steel sheet, unless otherwise indicated.
3. Pairs of Doors: Size pairs of doors to provide the following maximum gap between leafs to permit proper functioning of dead latching feature:
   a. Non-Rated Doors: Maximum 3/16-inch gap.
4. Glazed Lites: Factory cut openings in doors.
5. Coordinate door undercut to provide 1/2 inch clearance from top of floor covering. Coordinate locations where tile floor coverings occur.

D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
4. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor. Provide floor anchors for all frames. Floor anchors are in addition to jamb anchors.
5. Jamb Anchors: Provide number and spacing of anchors as follows:
   a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      1) Two anchors per jamb up to 60 inches high.
      2) Three anchors per jamb from 60 to 90 inches high.

3) Four anchors per jamb from 90 to 120 inches high.
4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
1) Three anchors per jamb up to 60 inches high.
2) Four anchors per jamb from 60 to 90 inches high.
3) Five anchors per jamb from 90 to 96 inches high.
4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.

c. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

6. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.

7. Provide welded frames with temporary spreader bars for shipping. Shipping spreader bars to be removed before installation, with template jig used to properly square up and space jambs.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated on Shop Drawings, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware. Through bolting will not be acceptable.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Provide fixed frame moldings on secure side of interior doors and frames.
3. Provide loose stops and moldings on inside of hollow metal work.
4. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.9 STEEL FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Apply primers to hollow metal doors and frames after assembly.

2. All interior and exterior doors and frames shall be factory primed to assure proper preparation and bond of primer. Bare galvannealed or galvanized steel for field priming not permitted.

B. Comply with SSPC-PA1, "Paint Application Specification No. 1," for steel sheet finishes.

C. Metallic-Coated Steel Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
   1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

D. Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

E. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

C. If unacceptable conditions are encountered, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 PREPARATION

A. Review finish schedules and verify flooring thickness to permit frame to be set at proper elevation to maintain undercut clearance of factory fit wood and hollow metal doors, providing not less than 1/4 inch clearance from finish floor.

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

C. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
   1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

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

3.3 INSTALLATION

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

B. Hollow Metal Frames: Install hollow metal frames for doors, borrowed lights, and other openings, of size and profile indicated. Comply with ANSI/SDI A250.11.
   1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
      a. At fire-protection-rated openings, install frames according to NFPA 80.
      b. Install frames with removable glazing stops located on secure side of opening.
      c. Install door silencers in frames before grouting.
      d. Remove shipping straps at bottom of frames. Properly space frame using wood template that is full depth of frame and of proper spacing width during setting and anchoring of frames to maintain proper width, with frame plumb and square without twists. Remove temporary braces necessary for installation only after frames have been properly set and secured. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
      e. Set bottom of frames at required elevations to provide proper undercut clearance of factory fit doors.
      f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
      g. Field apply bituminous coating to backs of frames that are filled with grout.
   2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors. Floor anchors are in addition to wall anchors.
      a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
   3. Stud Partitions: Attach wall anchors to studs with screws. Provide floor anchor at each jamb, in addition to the wall anchors. Use galvanized fasteners at exterior locations.
   4. Masonry Walls: Anchors shall be masonry T-shaped anchors. Provide floor anchor at each jamb, in addition to the wall anchors. Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
   5. Existing In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

6. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
    a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
    b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
    c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.
4. Pairs of Doors: Install pairs of doors to provide the following maximum gap between leafs and accurate alignment of strike to permit proper functioning of dead latching feature:
    a. Non-Rated Doors: Maximum 3/16-inch gap.

D. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

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

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

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

END OF SECTION 081113

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Wall access doors and frames.

B. Related Sections include the following:
   1. Division 04 Section "Unit Masonry Assemblies" for anchoring and grouting access door frames set in masonry construction.
   2. Division 23 Sections for heating and air-conditioning duct access doors.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of door and frame indicated. Include construction details, materials, individual components and profiles, and finishes.

C. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other Work.

D. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain access door(s) and frame(s) through one source from a single manufacturer.

B. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment. Coordinate with architectural, plumbing and mechanical drawings for locations of wall access doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 STEEL MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
   1. ASTM A 123/A 123M, for galvanizing steel and iron products.
   2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Steel Sheet: Uncoated cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

C. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. 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. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.

D. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.3 STAINLESS-STEEL MATERIALS

A. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304. Remove tool and die marks and stretch lines or blend into finish.
   1. Finish: Directional Satin Finish, No. 4.

2.4 PAINT

A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

2.5 ACCESS DOORS AND FRAMES

A. Flush Access Doors and Frames with Exposed Trim for Masonry Walls: Fabricated from steel sheet, except as noted. Provide stainless steel sheet for units in walls within toilet rooms, and janitor's closets and for units adjacent to sinks, water closets, urinals and similar fixtures that could cause fluids to come into contact with access door and frame.
   1. Locations: Masonry wall surfaces.
   2. Door: Minimum 0.070-inch- thick (14 gage) sheet metal, set flush with exposed face flange of frame.
   3. Frame: Minimum 0.060-inch- thick (16 gage) sheet metal with 1-inch- wide, surface-mounted trim.

4. Hinges: Spring-loaded concealed pin type or continuous piano hinge (stainless steel for stainless steel units).
5. Latch: Screwdriver- operated cam latch.
6. Lock: Key-operated cylinder lock in locations accessible by the public.
7. Products:
    a. J. L. Industries, Inc.; Model TM.
    b. Karp Associates, Inc.; DSC-214M.
    c. The Williams Brothers Corporation of America; WB-GPS.
    d. Provide comparable units where stainless steel units are indicated.

B. Flush Access Doors and Trimless Frames for Drywall: Fabricated from steel sheet, except as noted. Provide stainless steel sheet for units in walls within toilet rooms, and janitor's closets and for units adjacent to sinks, water closets, urinals and similar fixtures that could cause fluids to come into contact with access door and frame.
1. Locations: Gypsum board wall and ceiling surfaces.
2. Door: Minimum 0.070-inch- thick (14 gage) sheet metal, set flush with surrounding finish surfaces.
3. Frame: Minimum 0.060-inch- thick (16 gage) sheet metal with drywall bead.
4. Hinges: Spring-loaded concealed pin type continuous piano hinge (stainless steel for stainless steel units).
5. Latch: Screwdriver- operated cam latch.
6. Lock: Key-operated cylinder lock in locations accessible by the public.
7. Products:
    a. J. L. Industries, Inc.; Model WB.
    b. Karp Associates, Inc.; KDW.
    c. The Williams Brothers Corporation of America; WB-DW.
    d. Provide comparable products where stainless steel units are indicated.

2.6 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Steel Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
1. Exposed Flanges: Nominal 1 to 1-1/2 inches wide around perimeter of frame.
2. For trimless frames with drywall bead for installation in gypsum board assembly, provide edge trim for gypsum board securely attached to perimeter of frames.
3. Provide mounting holes in frames to attach frames to metal framing.
4. Furnish adjustable metal masonry anchors.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
1. For cylinder lock, furnish two keys per lock and key all locks alike.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.8 STEEL FINISHES

A. Surface Preparation: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:
   1. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

B. Apply shop primer to uncoated surfaces of metal fabrications. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

2.9 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Bright, Directional Polish: No. 4 finish.
   1. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install access doors with trimless frames flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

SECTION 083323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Electrically operated, service door.

B. Related Sections:
   1. Division 05 Section "Metal Fabrications" for miscellaneous steel supports and steel door frames.
   2. Division 26 Sections for electrical service and connections for powered operators and accessories.

1.3 PERFORMANCE REQUIREMENTS

A. Operation Cycles: Provide overhead coiling door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type and size of overhead coiling door and accessory. Include the following:
   1. Construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
   2. Summary of forces and loads on walls and jambs.
   3. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
   4. For fire-rated doors, description of fire-release system including testing and resetting instructions.
   5. Installation instructions.

C. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. 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. Wiring Diagrams: For power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring, and between components provided by door manufacturer and those provided by others.

D. Qualification Data: For qualified Installer signed by manufacturer certifying that Installer complies with specified requirements.

E. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

F. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

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

B. Source Limitations: Obtain all overhead coiling doors from single source as complete units, including operators, controls, hardware, accessories, and mounting and installation components, from single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of overhead coiling doors that fail in materials or workmanship within specified warranty period.
1. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 (Z275) zinc coating; nominal sheet thickness (coated) of 0.028 inch and as required to meet requirements.

B. Bottom Bar: Consisting of two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from manufacturer's standard hot-dip galvanized steel extrusions to match curtain slats and finish.
1. Provide motor-operated doors with combination bottom astragal and sensor edge.

C. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide

adjustment. Provide removable stops on guides to prevent overtravel of curtain. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize noise of travel.

2.2 HOOD

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
   1. Galvanized Steel: Nominal 0.028-inch- thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653/A 653M.
   2. Include automatic drop baffle on fire-rated doors to guard against passage of smoke or flame.

2.3 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs. Tension shall be adjustable from outside of end bracket plate, except on integral frame construction.

D. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.
   1. Bracket Plate for Pipe Counterbalancing Shaft: Not less than 1/4-inch thick; house ends of shutter coil.
   2. Drive End Bracket Plate: Not less than 1/4-inch thick; fitted with a sealed ball bearing.

2.4 ELECTRIC DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
   1. Comply with NFPA 70.
   2. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24 V, ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
   1. Standard duty, up to 60 cycles per hour.

C. Door Operator Type: Provide bracket-mounted, standard duty, jackshaft-type door operator unit consisting of electric motor, enclosed worm-gear running-in-oil primary drive, and chain and sprocket secondary drive. Provide quick disconnect-release for manual operation.

D. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 11 Section "Common Motor Requirements for Equipment" unless otherwise indicated.
   1. Electrical Characteristics:
      a. Phase: Single phase.
      b. Volts: 115 V.
      c. Hertz: 60.
      d. Horsepower: 1/2.
   2. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.
   3. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
   4. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
   5. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed. Low voltage wiring and conduit from operating controls to the operator provided in Division 26.

E. Obstruction Detection Device: Equip motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.
   1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
      a. Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained pressure on close button.
   2. Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
      a. Self-Monitoring Type: Four-wire configured device designed to interface with door operator control circuit to detect damage to or disconnection of sensor edge.

F. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open,"and "Close" with On/Off keyed switch.
   1. Interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

G. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.

H. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

I. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

J. Radio-Control System: Consisting of the following:
1. Three-channel universal coaxial receiver to open, close, and stop door; two per operator.
2. Multifunction remote control.

2.5 DOOR ASSEMBLY

A. Electrically Operated, Service Door, Door A122: Overhead coiling door formed with curtain of interlocking metal slats.
1. Product: Cookson Company; Model FCM.

B. Operation Cycles: Not less than 50,000.
1. Include tamperproof cycle counter.

C. Door Curtain Material: Galvanized steel.

D. Door Curtain Slats: Flat profile slats of 2-1/4-inch center-to-center height.

E. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.

F. Hood: Match curtain material and finish.
1. Shape: Round.
2. Mounting: Face of wall.

G. Electric Door Operator:
1. Usage Classification: Standard duty, up to 60 cycles per hour.
2. Operator Location: As shown on Drawings.
3. Motor Exposure: Interior.
4. Emergency Manual Operation: Push-up type.
5. Obstruction-Detection Device: Automatic photoelectric sensor and electric sensor edge on bottom bar.
a. Sensor Edge Bulb Color: Black .
6. Remote-Control Station: Interior type unit located on outside of door.
7. Other Equipment: Radio-control system.

H. Door Finish:
1. Powder-Coated Finish: Color as selected by Architect from manufacturer's standard range.
2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 STEEL AND GALVANIZED-STEEL FINISHES

A. Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Examine locations of electrical connections.

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

3.2 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions, approved Shop Drawings, and as specified.

B. Install overhead coiling doors, hoods, and operators at the mounting locations indicated for each door.

C. Install units plumb and true, free of warp or twist, and within tolerances specified by manufacturer for smooth operation.

D. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Perform installation and startup checks according to manufacturer's written instructions.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   3. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

3.4 ADJUSTING

A. After completion of installation, including work by other trades, adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide tight fit around entire perimeter.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.
   1. Review data in Maintenance Manuals.
   2. Schedule training with Owner with at least 7 days advance notice.

END OF SECTION 083323

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SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Exterior storefront framing.
   2. Operable window units in storefront.
   3. Break metal in conjunction with frames.
   4. Sealant at exterior perimeter of storefront.

B. Related Requirements:
   1. Division 07 Section "Joint Sealants" for installation requirements of joint sealants installed with aluminum-framed systems and for sealants to the extent not specified in this Section.
   2. Division 08 Section "Glazing" for glazing and spandrel panel requirements to the extent not specified in this Section.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to glazed aluminum storefront and entrance systems including, but not limited to, the following:
   1. Meet with Owner; Architect; storefront and entrance systems Installer; storefront and entrance systems manufacturer's representative; and installers whose work interfaces with or affects storefront and entrance systems.
   2. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
   3. Review structural loading limitations.
   4. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   5. Review required inspecting, testing, and certifying procedures.
   6. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions.
   7. Review temporary protection requirements for existing construction during and after installation.
   8. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.
   9. Provide minimum advance notice of 5 business days to participants prior to convening preinstallation conference.

1.4 ACTION SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes. Include manufacturer's installation instructions for system(s) specified.

C. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
   1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
   2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
      a. Joinery, including concealed welds.
      b. Anchorage.
      c. Expansion provisions.
      d. Glazing.
      e. Flashing and drainage.
   3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
   4. Indicate fastener layout and size for transferring loads back to supporting structure.

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

E. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and professional engineer.

B. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by a qualified independent testing agency.

C. Manufacturer's Field Reports: Manufacturer's field service representative shall submit field inspection report of product installation to Architect.

D. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Professional Engineer Qualifications: A professional structural engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of glazed storefront systems that are similar to those indicated for this Project in material, design, and extent.

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

D. Field Quality Control: Provide manufacturer's field services consisting of product use recommendations, site visit at commencement of work, and periodic site visit for inspection of product installation in accordance with manufacturer's instruction. Manufacturer's field representative shall prepare written report on installation of systems.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.
   1. Coordinate rough opening, masonry opening, and wood blocking requirements.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Failure of system to meet performance requirements.
      c. Noise or vibration created by wind and thermal and structural movements.
      d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      e. Adhesive or cohesive sealant failures.
      f. Water penetration through fixed glazing and framing areas.
      g. Failure of operating components.
      h. Glazing breakage.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional structural engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction. Aluminum-framed entrances and storefronts shall withstand the effects indicated and the requirements of IBC 2009.
   1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
   2. Failure also includes the following:
      a. Thermal stresses transferring to building structure.
      b. Deflection exceeding specified limits.
      c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
      d. Glass breakage.
      e. Noise or vibration created by wind and thermal and structural movements.
      f. Loosening or weakening of fasteners, attachments, and other components.
      g. Failure of operating units.
      h. Sealant failure.

C. Structural Loads:
   1. Wind Loads: As indicated on Drawings.

D. Deflection of Framing Members: At design wind pressure, as follows:
   1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
   2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.
      a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.
   3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:
      a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans less than 11 feet 8-1/4 inches.

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

F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
   1. Fixed Framing and Glass Area:
      a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
   2. Operable Window Units: Maximum air leakage of 0.10 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft..

G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
   1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..

H. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
   2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
      a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
      b. Low Exterior Ambient-Air Temperature: 0 deg F.
      c. Interior Ambient-Air Temperature: 75 deg F.

2.2 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the following:
   1. Kawneer North America:
      a. Exterior Storefront and Entrances: Trifab 451T frames with 350 Heavy Wall Entrances and Trifab VG 451 Heavy Wall Frames.
      b. Operable Vents: Sealair Series 6200T Outswing Casement Units.
   2. Oldcastle Building Envelope (Formerly Vistawall):
      a. Exterior Storefront and Entrances: Series 3000 poured and debridged Thermal Storefront System with Rugged MS Entrances and Thermally Broken Heavy Wall Frames.
      b. Operable Vents: 2020 Vent SSG.

B. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing, entrance doors, venting windows, and accessories, from single manufacturer.

2.3 FRAMING

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
   1. Construction: As follows:
      a. Exterior Framing Members: Composite assemblies of two separate extruded-aluminum components permanently bonded by an elastomeric material of low thermal conductance.

b. Interior Framing Members: Nonthermal.
c. Assembly System: Shear block.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Front.
4. Finish: Clear anodic finish.
5. Provide components having face width indicated on Drawings.
6. Provide thermally broken extruded aluminum sill flashing with end dams for storefronts.
7. Provide operable units (doors and windows) manufactured by storefront system manufacturer.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
1. Provide extra-heavy reinforcement for hinges and closers at doors over 7 feet in height.

D. Materials:
1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
a. Sheet and Plate: ASTM B 209.
b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
d. Structural Profiles: ASTM B 308/B 308M.
2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 VENTING WINDOWS

A. Casement Windows: Provide manufacturer's thermally broken, outward swinging window designed for use in storefront system. Finished to match storefront system.
1. Window Type: Casement.
2. Minimum Performance Class: CW.
3. Minimum Performance Grade: Not less than 40.
4. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 0.064-inch thickness at any location for main frame and sash members.
a. Thermally Improved Construction: Fabricate window units with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.
5. Fasteners, Anchors, and Clips: Nonmagnetic stainless steel, aluminum, or other noncorrosive material, compatible with aluminum window members, trim, hardware,

anchors, and other components of window units. Fasteners shall not be exposed, except for attaching hardware.

a. Reinforcement: Where fasteners screw-anchor into aluminum less than 0.128 inch thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, spline grommet nuts.

6. Hardware: Manufacturer's standard; of aluminum, stainless steel, die-cast steel, malleable iron, or bronze; including the following:
   a. Operator: Heavy duty roto operator.
   b. Locking: Single lever two-point latching.
   c. Hinges: Comply with AAMA 904; concealed, stainless steel, four-bar friction hinge with adjustable-slide friction shoe; two per ventilator.
      1) Friction Shoes: Provide friction shoes of nylon or other nonabrasive, nonstaining, noncorrosive, durable material.
   d. Weather Stripping: Manufacturer's standard compressible, replaceable weather stripping designed for permanently sealing under bumper action around full perimeter of unit, and completely concealed when ventilator is closed.
7. Insect Screens: Provide removable insect screen on each operable exterior sash, with screen frame finished to match window unit, complying with SMA 1004 or SMA 1201, and as follows:
   a. Glass-Fiber Mesh Fabric: 18-by-16 or 18-by-14 mesh of PVC-coated, glass-fiber threads, woven and fused to form a fabric mesh; complying with ASTM D 3656.

B. Glazing: Same as adjacent aluminum-framed entrances and storefront glazing.

C. Finish: Match adjacent aluminum-framed entrances and storefront finish.

2.5 GLAZING

A. Glazing: Provided in with Section 088000 "Glazing."

B. Weatherseal Sealants: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed storefront manufacturers for this use.
   1. Color: As selected by Architect.

2.6 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
   2. Reinforce members as required to receive fastener threads.
   3. Do not use exposed fasteners, except for hardware application. For hardware application, use exposed fasteners with countersunk Phillips screw heads, finished to match framing system or hardware being fastened, unless otherwise noted. Exposed fasteners shall be stainless steel.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

E. Aluminum Break Metal: Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness, not less than 0.063-inch thick, to maintain a flat appearance without visible deflection.

F. Exterior Aluminum Closure Covers: Fabricated from sheet aluminum finished to match framing and of sufficient thickness, not less than 0.125-inch thick, to maintain a flat appearance without visible deflection; provide with metal clips to engage cover.

2.7 FABRICATION

A. General: Fabricate glazed aluminum storefront system assemblies according to approved Shop Drawings. Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

B. Form or extrude aluminum shapes before finishing.

C. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

D. Fabricate components that, when assembled, have the following characteristics:
1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from exterior.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

E. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

F. Storefront Framing: Fabricate components for assembly using shear-block system.

G. Windows: Fabricate aluminum windows with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact. Fabricate units that are reglazable without dismantling sash or ventilator framing.

1. Provide hardware with low conductivity or nonmetallic material for hardware bridging thermal breaks at frame or vent sash.
2. Provide full-perimeter weather stripping for each operable sash and ventilator.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 50 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.9 SOURCE QUALITY CONTROL

A. Structural Sealant: Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. Confirm that wood blocking, where used, has been sufficiently fastened to transfer storefront wind loads back to structure.

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

3.2 INSTALLATION

A. General:
1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:
1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation. Install sills in one piece, full width of opening except where opening exceeds available manufactured lengths. Provide sealed metal end dams at ends of sills. Sills shall turn up on backside to form pan, directing water to the exterior.

E. Install components plumb and true in alignment with established lines and grades.

F. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

G. Install glazing as specified in Division 08 Section "Glazing."

H. Install weatherseal sealant according to Division 07 Section "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer. Color of sealant to match aluminum finish.

3.3 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
   1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
   2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
   3. Alignment:
      a. Where surfaces about in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
      b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
      c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
   4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

END OF SECTION 084113

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Commercial door hardware for the following:
      a. Swinging doors.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section “Submittal Procedures”.
   1. Submittals for Sections “Steel Frames”, “Wood Doors” and “Door Hardware” shall be made concurrently.

B. Product Data: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
   1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
   2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.
      a. Organize door hardware sets in same order as in the Door Hardware Schedule at the end of Part 3.
   3. Content: Include the following information:
      a. Type, style, function, size, label, hand, and finish of each door hardware item.
      b. Manufacturer of each item.
      c. Fastenings and other pertinent information.
      d. Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
      e. Explanation of abbreviations, symbols, and codes contained in schedule.
      f. Mounting locations for door hardware.
      g. Door and frame sizes and materials.
      h. Provide hardware for every door in the project, except as indicated, so that each door functions correctly for its intended use. Where a door is not included in the Door Hardware Schedule at end of Part 3, provide hardware scheduled for similar type opening and review with Architect.
   4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of

other work that is critical in the Project construction schedule. Include Product Data, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

D. Keying Schedule: Meet directly with the Owner to review hardware function and keying requirements before ordering hardware. Prepare keying schedule by or under the supervision of supplier, detailing Owner's final keying instructions for locks.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
   1. Include lists of completed projects with project names and addresses of architects and owners, and other information specified.

F. Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Division 01.

G. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Supplier Qualifications: Door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
   1. Scheduling Responsibility: Preparation of door hardware and keying schedules.

C. Architectural Hardware Consultant Qualifications: A person who is currently certified by the Door and Hardware Institute as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

D. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

E. Regulatory Requirements: Comply with provisions of the following:
   1. Comply with all applicable codes. Comply with Americans with Disabilities Act (ADA), as follows:
      a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
      b. Door Closers: Comply with the following maximum opening-force requirements indicated:
         1) Interior Hinged Doors: 5 lbf applied perpendicular to door.
         2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
      c. Thresholds (Public Traffic Doors): Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.
   2. NFPA 101: Comply with the following for means of egress doors:

a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
b. Door Closers: Not more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.
c. Thresholds (Public Traffic Doors): Not more than 1/2 inch high.

F. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 and NFPA 101 without exception. Provide only hardware tested by UL for the type and size of door installed and fire resistance rating required.
1. UL 10C - Positive Pressure Test of Fire Door Assemblies

G. Keying Conference: Conduct conference directly with the Owner. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to door hardware including, but not limited to, the following:
1. Inspect and discuss preparatory work performed by other trades.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review required testing, inspecting, and certifying procedures.
4. Review proper installation procedures for locksets, exit devices and closers with Installer and Hardware Supplier.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, and access control system.

1.7 WARRANTY

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

B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
   1. Structural failures including excessive deflection, cracking, or breakage.
   2. Faulty operation of operators.
   3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

C. Warranty Period for Manual Closers: 10 years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

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

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section, and the Door Hardware Schedule at the end of Part 3.
   1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturer's products.

B. Manufacturers: The USM Gorham Campus has standardized door hardware requirements to provide campus wide consistency of locking, keying, inventory of parts, and ability to maintain the facilities. Products indicated with a single manufacturer shall be furnished as specified, no substitutions.

2.2 HINGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Hinges:
      a. Hager Companies.
      b. McKinney Products Company; Div. of ESSEX Industries, Inc.
      c. Stanley Commercial Hardware; Div. of The Stanley Works.

B. Standards: Comply with the following:
   1. Butts and Hinges: BHMA A156.1.
   2. Template Hinge Dimensions: BHMA A156.7.

C. Quantity: Provide the following, unless otherwise indicated:
   1. Two Hinges: For doors with heights up to 60 inches.
   2. Three Hinges: For doors with heights 61 to 90 inches.
   3. Four Hinges: For doors with heights 91 to 120 inches.
   4. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

D. Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

Maximum Door Size (inches)	Hinge Height (inches)	Metal Thickness (inches)	
		Standard Weight	Heavy Weight
40 and under by 1-3/4	4-1/2	0.134	0.180
Over 40 by 1-3/4	5	0.146	0.190

E. Hinge Weight: Unless otherwise indicated, provide the following:
1. Entrance Doors: Heavy-weight hinges.
2. Stair Doors: Heavy-weight hinges.
3. Doors with Closers: Antifriction-bearing hinges.
4. Interior Doors: Standard-weight hinges, oil-impregnated bearings unless specified otherwise.

F. Hinge Base Metal: Unless otherwise indicated, provide the following:
1. Exterior Hinges: Stainless steel, with stainless-steel pin.
2. Interior Hinges: Steel, with steel pin.
3. Hinges for Fire-Rated Assemblies: Steel, with steel pin.

G. Hinge Options: Comply with the following:
1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:
   a. Outswinging exterior doors.
   b. Outswinging interior doors with locks.
2. Corners: Square.
3. Coordinate hinge requirements and reinforcement with aluminum door supplier.

H. Fasteners: Comply with the following:
1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
2. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
3. Screws: Phillips flat-head screws; machine screws (drilled and tapped holes) for metal doors. Finish screw heads to match surface of hinges.

2.3 LOCKS AND LATCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Mechanical Locks and Latches:
   a. Schlage Lock Company.

B. Bored Locks: Heavy duty locks with lever handles, deadlocking latch bolt, core to receive cylinder provided by Owner, BHMA A156.2
1. Schlage ND Series

C. Auxiliary Locks: BHMA Grade 1.

D. Lock Trim: Comply with the following:
   1. Lever: Forged or Cast.
   2. Escutcheon (Rose): Wrought, forged, or cast.

E. Lock Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:
   1. Minimum 3/4-inch latchbolt throw.

F. Backset: 2-3/4 inches, unless otherwise indicated.

2.4 EXIT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Stanley Commercial Hardware; Div. of The Stanley Works (Precision Hardware, Inc.).
   2. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc.

B. Products: All exit devices for this project shall be one of the following:
   1. Stanley (Precision) Olympian Series
   2. The 80 Series exit device by Sargent & Co.

C. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

D. Outside Trim: Lever with cylinder; cylinder at doors scheduled to receive pulls; material and finish to match locksets, unless otherwise indicated.
   1. Match design for locksets and latchsets, unless otherwise indicated.

2.5 CYLINDERS AND KEYING

A. Available Manufacturers: Match existing system.
   1. Cylinders: Cores provided by Owner. Ensure all hardware compatibility with Small Format Interchangeable Core 7-Pin Cores and rim type cylinders provided by owner.

B. Keying System: Prepare keying schedule with the Owner. Owner will obtain keys with the cores.

C. Keys: Provided by Owner.

2.6 STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated.

2.7 OPERATING TRIM

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. Burns Manufacturing Incorporated (BM).
   2. NT Quality Hardware; an Ingersoll-Rand Company (NTQ).
   3. Rockwood Manufacturing Company (RM).

C. Standard: Comply with BHMA A156.6, solid bar.

D. Materials: Fabricate from stainless steel, unless otherwise indicated.
   1. Push-Pull Design: Door Pulls: 1inch diameter by 10 inches long.
      a. Rockwood BF111
      b. Burns BF26C
      c. Quality BF163-10"

E. Removable Mullions:
   1. Corbin Russwin Architectural Hardware; Div. of Yale Security Inc. (CR).
   2. Stanley (Precision) Hardware, Inc. (PH).
   3. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).
   4. Von Duprin; an Ingersoll-Rand Company (VD).

2.8 CLOSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Surface-Mounted Closers:
      a. LCN Closers; an Ingersoll-Rand Company (LCN).
      b. Model: 4040 Series.

B. Standards: Comply with the following:
   1. Closers: BHMA A156.4.

C. Surface Closers: BHMA Grade 1, cast-iron body.
   1. Door closers shall have fully hydraulic, full rack and pinion action. Cylinder body shall be 1-1/2" in diameter, and double heat treated pinion shall be 11/16" in diameter.
   2. Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force for the physically handicapped. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed, and hydraulic back-check.
   3. All closers shall have solid forged steel main arms (and forged forearms for parallel arm closers).
   4. Closer arms shall have a powder coating finish.
   5. Provide drop, mounting plates where required.
   6. Do not locate closers on the side of doors facing corridors, passageways or similar type areas. Where it is necessary, due to certain conditions and approval of the Architect, to have closers in corridors, provide such closers with parallel or track type arms.
   7. Door closers shall be adjusted by the installer in accordance with the manufacturer's templates and written instructions. Closers with parallel arms shall have back-check features adjusted prior to installation.
   8. Closers shall conform to all applicable code and law requirements relative to setting closing speeds for closers and maximum pressure for operating interior and exterior doors.

D. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.9 PROTECTIVE TRIM UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Metal Protective Trim Units:
      a. Burns Manufacturing Incorporated (BM).
      b. Don-Jo Mfg., Inc. (DJO).
      c. Rockwood Manufacturing Company (RM).

B. Standard: Comply with BHMA A156.6.

C. Materials: Fabricate protection plates from the following:
   1. Stainless Steel: 0.050 inch thick; beveled top and 2 sides.

D. Fasteners: Provide manufacturer's oval head exposed fasteners for door trim units consisting of either machine or self-tapping screws, for installation in counter sunk holes.

E. Furnish protection plates sized 2 inches less than door width on push side by the following height:
   1. Kick Plates: 8 inches
   2. Push Plates: 8 inches wide by 16 inches high.

2.10 STOPS AND HOLDERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
   2. Hager Companies (HAG).
   3. Ives: H. B. Ives (IVS).
   4. Rixson-Firemark, Inc.; Div. of Yale Security Inc. (RIX).
   5. Rockwood Manufacturing Company (RM).

B. Standards: Comply with the following:
   1. Stops and Bumpers: BHMA A156.16.
   2. Door Silencers: BHMA A156.16.

C. Stops and Bumpers: BHMA Grade 1.
   1. Wall Stops: Convex with concealed mounting.
   2. Floor Stops: Dome stop, base thickness to accommodate flooring thickness.

D. Wall Stops: For doors, unless floor or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic.
   1. Where floor or wall stops are not appropriate, provide heavy duty overhead holders.
      a. Glynn-Johnson GJ90.
      b. Sargent 590.

E. Silencers for Metal Door Frames: BHMA Grade 1; neoprene or rubber, minimum diameter 1/2 inch; fabricated for drilled-in application to frame.

2.11 DOOR GASKETING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Door Gasketing and Door Bottoms:
      a. National Guard Products, Inc. (NGP).
      b. Pemko Manufacturing Co., Inc. (PEM).
      c. Reese Enterprises, Inc. (RE).
      d. Zero International, Inc. (ZRO).

B. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
   1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
   2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

C. 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 gasketing on fire-rated doors and on smoke-labeled doors. Basis-of-Design Product, No. 5050 by National Guard Products or approved substitute.

2.12 THRESHOLDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. National Guard Products, Inc. (NGP).
   2. Pemko Manufacturing Co., Inc. (PEM).
   3. Reese Enterprises, Inc. (RE).
   4. Zero International, Inc. (ZRO).

B. Standard: Comply with BHMA A156.21.

C. General: Extruded aluminum, depth as required for sill condition. Where thresholds extend out beyond face of frame, provide returned closed ends by miter cutting on a 45 degree angle and return to face of frame.

2.13 FABRICATION

A. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18 for finishes. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

B. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Steel Machine or Wood Screws: For the following fire-rated applications:
    a. Mortise hinges to doors.
    b. Strike plates to frames.
    c. Closers to doors and frames.
3. Spacers or Sex Bolts: For through bolting of hollow metal doors.
4. Fasteners for Wood Doors: Comply with requirements of DHI WDHS.2, "Recommended Fasteners for Wood Doors."

2.14 FINISHES

A. Standard: Comply with BHMA A156.18.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. BHMA Designations: Comply with base material and finish requirements indicated by the following:
1. BHMA 626 (US26D): Satin chromium plated over nickel, over brass or bronze base metal.
2. BHMA 630 (US32D): Satin stainless steel, over stainless-steel base metal.

E. With the exceptions of exit devices, door closers, plates, push bars, pulls, thresholds and weatherstripping, all hardware items shall be furnished in dull chrome finish 26D.
1. Exceptions are as follows:
    a. Exit Devices: 32D
    b. Door Closers: Sprayed Aluminum
    c. Plates: 32D
    d. Push Bars: 32D
    e. Pulls: 32D

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance. If errors in dimensions or preparation are encountered, they are to be corrected by the responsible parties prior to the installation of hardware.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

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

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 series.
   1. Surface-Applied Door Hardware: Drill and tap doors and frames according to SDI 107.

B. Wood Doors: Comply with DHI A115-W series.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
   1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
   2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
   1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Exit devices shall be carefully installed so as to permit friction free operation of crossbar, touch bar and lever. Latching mechanism shall also operate freely without friction or binding.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
   1. Door Closers: Adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

B. Six-Month Adjustment: Approximately six months after date of Substantial Completion, Installer shall perform the following:
   1. Examine and readjust each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.
   2. Consult with and instruct Owner's personnel on recommended maintenance procedures.
   3. Replace door hardware items that have deteriorated or failed due to faulty design, materials, or installation of door hardware units.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.

3.7 DOOR HARDWARE SCHEDULE

Heading 1
Door 101, 101B (New Door in Existing Frame)
Each Leaf Shall Have: BB Hinges, Lockset (Entrance Function), Closer, Kick Plate, Weather-strip gasketing, Threshold

Heading 2
Door 102
Each Leaf Shall Have: BB Hinges, Lockset (Entrance Function), Closer, Kick Plate, Weather-strip gasketing, Threshold

Heading 3
Door 102B
Each Leaf Shall Have: BB Hinges, Lockset (Office Function), Closer, Kick Plate, Smoke-Labeled Gasketing, Stop

Heading 4
Doors 103, 105
Each Leaf Shall Have: BB Hinges, Lockset (Storeroom Function), Closer, Kick Plate, Smoke-Labeled Gasketing, Stop

Heading 5
Door 104
Each Leaf Shall Have: BB Hinges, Lockset (Privacy Function), Closer, Kick Plate, Silencers, Stop

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Doors.
   2. Interior borrowed lites.
   3. Storefront framing.

1.3 DEFINITIONS

A. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

B. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

C. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

D. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

E. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

F. Deterioration of Silvered Mirrored Glass: Defects developed from normal use that are attributable to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning silvered mirrored glass contrary to mirrored glass manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
   1. Minimum glass thickness, nominally, is 6.0 mm (0.23 inch), unless indicated otherwise.

1.5 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each glass product and glazing material indicated.

C. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

D. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

E. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.

B. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201 and, for wired glass, ANSI Z97.1.
   1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.
   2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide glazing products that comply with Category II materials, and for lites 9 sq. ft. or less in area, provide glazing products that comply with Category I or II materials.

C. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. GANA Publications: GANA's "Glazing Manual."
   2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

3. NAAMM's Publication for Mirrored Glass: "Mirrors, Handle with Extreme Care, Tips for the Professional on the Care and Handling of Mirrors."

D. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:
   1. Insulating Glass Certification Council.
   2. Associated Laboratories, Inc.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

1.9 WARRANTY

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

B. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
   1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 MONOLITHIC GLASS PRODUCTS

A. Float Glass: ASTM C 1036; Type I (transparent flat glass), Class 1 (clear), Quality q3 (glazing select); 6 mm (0.23 inch) thick minimum.

B. Safety Glass: ASTM C 1048; Kind FT (fully tempered), Condition A (uncoated), Type I (transparent flat glass); Class 1 (clear); Quality q3 (glazing select); conforming to ANSI Z97.1; 6 mm (0.23 inch) minimum thick.

2.3 FIRE-PROTECTION-RATED GLAZING

A. Fire-Protection-Rated Glazing, General: Listed and labeled by Underwriters Laboratories (UL) a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies.

B. Laminated Ceramic Glazing: Laminated glass made from 2 plies of clear, ceramic flat glass; 5/16-inch total nominal thickness; complying with testing requirements in 16 CFR 1201 for Category II materials.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Nippon Electric Glass Co., Ltd. (distributed by Technical Glass Products); FireLite Plus.
   b. Schott North America, Inc.; Laminated Pyran Crystal.
   c. Vetrotech Saint-Gobain; SGG Keralite FR-L.
2. Fire-Protection Rating: As indicated for the assembly in which glazing material is installed, and permanently labeled by a testing and inspecting agency.

2.4 INSULATING VISION GLASS UNITS PRODUCTS

A. Solar Control Ultra Clear Low-E Insulated Glass Units: Uncoated insulating glass units complying with ASTM E 773 and E 774; double pane with glass elastomer edge seal.
1. Unit Thickness:
   a. For Exterior Locations Other Than Doors: Inner and outer panes of 6.0 mm (0.23 inch) glass; total unit thickness of 1 inch (25 mm) minimum.
   b. For Exterior Doors: Inner and outer panes of 3/16 inch glass; total unit thickness of 5/8 inch minimum.
2. Interspace Content: Argon.
3. Outdoor Lite: Class 1 (clear) float glass.
   a. Kind FT (fully tempered) where required by code and where indicated.
4. Indoor Lite: Class 1 (clear) float glass.
   a. Kind FT (fully tempered) where required by code and where indicated.
5. Low-E Coating: On third surface.
6. Meets or surpasses performance criteria: Visible Light Transmittance >= 74%, U-value (winter) <= .29, SHGC <=.40

B. Insulated Glass Units - Frosted: Solar Seal Heavy Blast Etched Glass.
1. Unit Thickness:
   a. Inner and outer panes of 6.0 mm (0.23 inch) glass; total unit thickness of 1 inch (25 mm) minimum.

2. Interspace Content: Argon.
3. Outdoor Lite: Heavy Blast Etched, 80 psi with 2 repetitions, float glass.
   a. Kind FT (fully tempered) where required by code and where indicated.
4. Indoor Lite: Class 1 (clear) float glass.
   a. Kind FT (fully tempered) where required by code and where indicated.
5. Low-E Coating: On third surface.
6. Meets or surpasses performance criteria: U-value (winter) <= .29, SHGC <=.40

2.5 INSULATING TRANSLUCENT GLASS UNITS PRODUCTS

A. Translucent Glazing Panels: ¼" clear tempered clear exterior lite, ¼" tempered clear interiror lite with the following construction (proprietary to *"Solera L"* by Advanced Glazings Ltd. of Sydney, Novia Scotia, Canada):
   1. Proprietary honeycomb transparent insulation core aligned perpendicular to glazing, for thermal glazing unit (TGU) thermal insulation.
   2. Translucent veils attached to both sides of honeycomb cell core adjacent to glass surfaces.
   3. Continuous perimeter metal spacer bar separated from glass surfaces with foam tape.
   4. Glass lites connected together with spacer bar using structural silicone sealant.
   5. Airspace within TGU filled with air pressure equalized to atmospheric pressure with stainless steel capillary pressure equalization (vent) tube located at top right corner of TGU, positioned with tube opening pointing downward (as viewed from building interior).

2.6 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
   1. EPDM, ASTM C 864.
   2. Silicone, ASTM C 1115.
   3. Thermoplastic polyolefin rubber, ASTM C 1115.
   4. Any material indicated above.

2.7 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:
   1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
   2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
   3. VOC Content: For sealants used inside of the weatherproofing system, products that comply with the California Department of Health Services "Standard Practice for the Testing Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda" or Greenguard Children & Schools Certification Program by Greenguard Environmental Institute.
   4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
   1. Neutral-Curing Silicone Glazing Sealants: ASTM C 920, Type S, Grade NS, Class 50, Use NT.
      a. Products:
         1) Dow Corning Corporation; 791.
         2) Dow Corning Corporation; 795.
         3) GE Advanced Materials - Silicones; SilPruf NB SCS9000.
         4) GE Advanced Materials - Silicones; UltraPruf II SCS2900.
         5) Pecora Corporation; 864.
         6) Pecora Corporation; 895.
         7) Pecora Corporation; 898.

C. Glazing Sealants for Fire-Resistive Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

2.8 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
   1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
   2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:
   1. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

H. Mirror Edge Sealer: Coating compatible with glass coating and approved by mirrored glass manufacturer for use in protecting against silver deterioration at mirrored glass edges.

I. Mirror Mastic: An adhesive setting compound, produced specifically for setting mirrored glass by spot application, certified by both mirrored glass manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrored glass will be installed.

J. Extruded-Aluminum Top and Bottom Trim: J-channels formed with a return deep enough to produce a glazing channel to accommodate mirrored glass units of thickness indicated and in lengths required to cover bottom edge of each mirrored glass unit in a single piece.
   1. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch in height, respectively, and a thickness of not less than 0.04 inch.
   2. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch in height, respectively, and a thickness of not less than 0.04 inch.
   3. Products: Subject to compliance with requirements, provide one of the following:
      a. Bottom Trim:
         1) CRL Standard "J" Channel; C. R. Laurence Co., Inc.
         2) Medium Gauge Aluminum Shallow Nose "J" Moulding Lower Bar; Sommer & Maca Industries, Inc.
         3) Heavy Gauge Aluminum Shallow Nose "J" Moulding Lower Bar; Sommer & Maca Industries, Inc.
      b. Top Trim:
         1) CRL Deep "J" Channel; C. R. Laurence Co., Inc.
         2) Medium Gauge Aluminum Deep Nose "J" Moulding Upper Bar; Sommer & Maca Industries, Inc.
         3) Heavy Gauge Aluminum Deep Nose "J" Moulding Lower Bar; Sommer & Maca Industries, Inc.

K. Window Speaker Through Units: Stainless steel unit with offset slots in front and rear to prevent tampering from outside.
   1. Product: Product: C. R. Laurence Co., Inc.; Model SST5.

2.10 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep system.
   3. Minimum required face or edge clearances.
   4. Effective sealing between joints of glass-framing members.

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

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance. Protect glass edges as follows:
   1. Use a rolling block in rotating glass units to prevent damage to glass corners.
   2. Do not impact glass with metal framing.
   3. Use suction cups to shift glass units within openings. Do not raise or drift glass with a pry bar.
   4. Rotate glass lites with flares or bevels on bottom horizontal edges so edges are located at top of opening, unless otherwise indicated by manufacturer's label.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications and standards, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.5 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass. Install pressurized gaskets to protrude slightly out of channel to eliminate dirt and moisture pockets.

3.7 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088000

SECTION 092950 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Interior gypsum wallboard.
   2. Non-load-bearing steel framing.
   3. Acoustical insulation in metal-framed assemblies.
   4. Acoustical sealants.

B. Related Sections include the following:
   1. Division 06 Section "Rough Carpentry" for concealed wood blocking in gypsum board assembly walls .
   2. Division 07 Section "Through-Penetration Firestop Systems" for systems installed in openings in walls and floors with and without penetrating items.
   3. Division 07 Section "Fire-Resistive Joint Systems" for fire-resistive joints not covered by work of this Section.
   4. Division 07 Section "Joint Sealants" for sealants not covered by work of this Section.
   5. Division 09 Section "Painting" for coordination/inspection requirements with painting contractor and primers applied to gypsum board surfaces.

1.3 DEFINITIONS

A. Gypsum Board Terminology: Refer to ASTM C 11 and GA-505 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product indicated.

C. Shop Drawings: Show locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of Work.
   1. Submit marked up floor plans with location of all control joints in gypsum board walls and ceilings.
   2. Firestopping: For each joint condition where fire-rated walls and partitions interface other walls, floors, structural members or other building structure, provide UL firestop system description and drawing. Show each kind of construction condition and relationships to adjoining construction. Indicate which firestop materials will be used where and thickness for different hourly ratings. Include UL firestop design designation that evidences compliance with requirements for each condition.

1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Fire-Resistance-Rated Assemblies: Indicated by design designations from UL's "Fire Resistance Directory," GA-600, "Fire Resistance Design Manual," or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.
   2. Deflection Firestop Track: Top runner indicated in fire-resistance-rated assemblies shall be labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.

B. Source Limitations for Steel Framing: Obtain steel framing members for gypsum board assemblies from a single source from a single manufacturer.

C. Source Limitations for Panel Products: Obtain each type of gypsum board and other panel products from a single source from a single manufacturer.

D. Source Limitations for Finishing Materials: Obtain finishing materials from either manufacturer supplying gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

E. Gypsum Board Finish Mockups: Before finishing gypsum board assemblies, install mockups using room designated by Architect to demonstrate aesthetic effects and qualities of materials and execution.
   1. Install mockups for surfaces indicated to receive nontextured paint finishes.
   2. Simulate finished lighting conditions for review of mockups.
   3. Mockup will be painted under Division 09 Section "Painting" to provide finished condition for viewing.
   4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

C. Stack gypsum panels flat on leveled supports off floor or slab to prevent sagging.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

D. Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less than 40 deg F. Do not exceed 95 deg F when using temporary heat sources.

E. Ventilation: Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
2. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized, unless otherwise indicated.

2.3 STEEL PARTITION AND SOFFIT FRAMING

A. Manufacturers:
1. Clark Dietrich Building Systems.
2. Super Stud Building Products, Inc.

B. Steel Studs and Runners: ASTM C 645.
1. Minimum Base Metal Thickness, Standard Framing: 0.0179 inch (25 gage) minimum, unless otherwise indicated.
a. Provide studs with 0.0329 inch (20 gage) minimum thickness at the following locations:
1) For 6 inch and greater framing.
2) For framing over 12 feet high.
3) For door jamb framing.
4) At locations to receive tile backer board.
5) Where indicated.
2. Gauge Equivalent Drywall Framing: For all studs locations, Minimum Design Thickness 0,023inches.
a. Clark Dietrich; ProSTUD 20.
b. Super Stud; The Edge Super 20.
3. Depth: As indicated.
4. Maximum Allowable Deflection: Increase metal thickness where required to meet the following:

a. Maximum Allowable Deflection for Drywall Assemblies: L/240 calculated using a 5 pound per square uniform load perpendicular to studs and based on stud properties alone.
b. Maximum Allowable Deflection for Tile Backing Panels: L/360 calculated using a 5 pound per square uniform load perpendicular to studs and based on stud properties alone.

C. Deep-Leg Deflection Track: ASTM C 645 top runner with flanges to allow for 3/4-inch deflection at floors and 1-1/2 inch at roofs.

D. Firestop Deflection Track: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs. Provide deflection track with flanges to allow for 3/4-inch deflection at floors and 1-1/2 inch at roofs.
1. Product: Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base Metal Thickness: 0.0598 inch (16 gage), unless indicated otherwise.

F. Cold-Rolled Channel Bridging: 0.0538-inch (16 gage) minimum bare steel thickness, with minimum 1/2-inch- wide flange.
1. Depth: 1-1/2 inches.
2. Clip Angle: 1-1/2 by 1-1/2 inch, 0.068-inch- thick, galvanized steel.

G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base Metal Thickness: 0.0312 inch (20 gage).
2. Depth: 7/8 inch, unless otherwise indicated.

H. Furring Brackets: Serrated-arm type, adjustable, fabricated from corrosion-resistant steel sheet complying with ASTM C 645, 20 gauge, .0329 inch, designed for screw attachment to steel studs and steel rigid furring channels used for furring.

I. Deflection Brackets:
1. Construction: Slotted galvanized steel angle with step bushing to prevent over tightening of fasteners.
2. Vertical Deflection: 1-1/2 inch total travel.
3. Product: VertiClip; Signature Industries, (919) 844-0789.
a. Series: SL, SDL, SLB, and SLS as required by attachment condition.

J. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.

2.4 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

B. Manufacturers:
1. G-P Gypsum Corporation.
2. National Gypsum Company.

3. United States Gypsum Company.

2.5 INTERIOR GYPSUM WALLBOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

B. Type X, GPDW:
1. Thickness: 5/8 inch.
2. Long Edges: Tapered.
3. Location: All locations, except as otherwise noted.

C. Moisture- and Mold-Resistant Type, GPDW-MR: ASTM C 1396/C 1396M and ASTM C 630 with moisture- and mold-resistant core and surfaces.
1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.
3. Mold-Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
4. Face Sheets: 100 percent post-consumer recycled content.
5. Location: Interior face of all exterior walls; walls and ceilings of toilet rooms, except as indicated otherwise; and where indicated.
    a. In toilet rooms use tile backer board behind tile.
6. Products:
    a. G-P Gypsum Corp.; Toughrock Mold-Guard Gypsum Board.
    b. National Gypsum Co.; Gold Bond Brand XP Gypsum Board.
    c. United States Gypsum Co.; Mold Tough Interior Panels.

D. Foil-Backed Type:
1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.
3. Location: Underside of trusses.

2.6 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: Complying with ASTM C 1178/C 1178M.
1. Products:
    a. DensShield Tile Guard; G-P Gypsum Corporation.
    b. National Gypsum Company; Gold Bond e^2XP Tile Backer Panel.
2. Core: 5/8 inch
3. Mold-Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
4. Locations: Behind wall tile.

2.7 TRIM ACCESSORIES

A. Interior Metal Trim: ASTM C 1047, galvanized steel.
1. Shapes:
    a. Cornerbead: 1-1/4 inch x 1-1/4 inch external corner with 1/8-inch nose bead. Use at outside corners, unless otherwise indicated.
    b. LC-Bead (Casing): J-shaped casing with 1/16-inch nose bead ground, not less than 30 gage; exposed long flange receives joint compound; use at exposed panel edges.
    c. Expansion (Control) Joint: One-piece control joint formed with V-shaped slot and removable strip covering slot opening.

2.8 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.

B. Joint Tape:
   1. Interior Gypsum Wallboard: Paper reinforcing tape. Fiberglass tape not permitted.
   2. Glass-Mat, Water-Resistant Tile Backing Panels: As recommended by panel manufacturer.

C. Setting-Type Joint Compound: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.
   1. Where setting-type joint compounds are indicated as a taping compound only or for taping and filling only, use formulation that is compatible with other joint compounds applied over it.

D. Drying-Type Joint Compound: Factory-packaged vinyl-based products complying with the following requirements for formulation and intended use.
   1. Ready-Mixed Formulation: Factory-mixed product.

E. Type of Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints, beveled panel edges, and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound or drying-type, all-purpose compound.
   3. Fill Coat: For second coat, use setting-type, sandable topping compound or drying-type, all-purpose compound.
   4. Finish Coat: For third coat, use setting-type, sandable topping compound or drying-type, all-purpose compound.

F. Joint Compound for Tile Backing Panels:
   1. Glass-Mat, Water-Resistant Backing Panel: As recommended by manufacturer.

2.9 ACOUSTICAL SEALANT

A. Products:
   1. Acoustical Sealant for Exposed and Concealed Joints:
      a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
      b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
   2. Acoustical Sealant for Concealed Joints:
      a. Ohio Sealants, Inc.; Pro-Series SC-175 Acoustical Sound Sealant.
      b. Pecora Corp.; AIS-919.
      c. Tremco, Inc.; Tremco Acoustical Sealant.

B. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

C. Acoustical Sealant for Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

2.10 SEALANTS FOR FIRE-RESISTANCE-RATED CONSTRUCTION

A. General: Provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Materials shall comply with Division 07 Section "Fire-Resistive Joint Systems" and submitted UL assemblies.
   1. Provide firestopping where fire rated gypsum board assemblies butt masonry, steel deck, joists, beams, and structural members as part of the gypsum board assembly work.
   2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
   3. Joints shall be sealed with fire-resistance-rated sealants; use of joint compound for sealing of joints is not permitted.

C. Exposed Fire-Resistive Joint Sealants: Exposed sealants shall be paintable.

2.11 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   1. Fastening gypsum board to steel members: Type S bugle head.
   2. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

C. Sound Attenuation Blankets (Acoustical Insulation): ASTM C 665, Type I (blankets without membrane facing) manufactured from inorganic glass bonded with thermosetting resin; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
   1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
   2. Manufacturers:
      a. Certainteed.
      b. Owens Corning.
      c. Johns Manville.

D. Insulation Support Anchors: Continuous, galvanized metal support strip, 25 gage, with pre-punched tabs at 8 inches on center.
   1. Product: Insul-hold; Insul-Hold Co., Inc.; phone (207) 465-9066.

E. Firestopping: See Division 07 Sections "Through-Penetration Firestop Systems" and "Fire-Resistive Joint Systems."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

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

D. Post-Installation Inspection: Inspect walls for dents and imperfections, with Installer and painter present, prior to painting. Verify exposed joints are finished up to required heights (to above acoustical ceilings and full height in rooms without ceilings). Inspect wall again after primer and first coat of paint applied, with Installer and painter present. Installer shall touch-up as follows:
   1. Touch-up visible gypsum board imperfections before priming of walls.
   2. Touch-up imperfections found in field of boards and joints made visible from painting after first finish coat applied.
   3. Joint compound touch-up shall be primed and painted and viewed for acceptability before final coat is applied.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

3.3 STEEL FRAMING INSTALLATION, GENERAL

A. Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.

B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with gypsum board manufacturer's written recommendations or, if none available, with United States Gypsum's "Gypsum Construction Handbook."

C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement. Comply with details shown on Drawings.
   1. Isolate ceiling assemblies where they abut or are penetrated by building structure.
   2. Isolate partition framing and wall furring where it abuts structure, except at floor. Install slip-type joints at head of assemblies that avoid axial loading of assembly and laterally support assembly.
      a. Allow for 3/4-inch deflection at floors and 1-1/2 inches at roofs.
      b. Install deflection track top runner or deflection brackets to attain lateral support and avoid axial loading.
      c. Install deflection firestop track top runner at fire-resistance-rated assemblies.
         1) Attach jamb studs at openings to tracks using manufacturer's standard stud clip.

D. Do not bridge building control and expansion joints with steel framing or furring members. Frame both sides of joints independently.

3.4 INSTALLING STEEL PARTITION AND SOFFIT FRAMING

A. Install tracks (runners) at floors, ceilings, and structural walls and columns where gypsum board assemblies abut other construction.

B. Installation Tolerance: Install each steel framing and furring member so fastening surfaces vary not more than 1/8 inch from the plane formed by the faces of adjacent framing.

C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
   1. Cut studs 1/2 inch short of full height to provide perimeter relief. Do not fasten studs to top track to allow independent movement of studs and track.
   2. For fire-resistance-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid-structure surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed to support gypsum board closures and to make partitions continuous from floor to underside of solid structure.

D. Install steel studs and furring at the following spacings:
   1. Single-Layer Construction: 16 inches o.c., unless otherwise indicated.

E. Install steel studs so flanges point in the same direction and leading edge or end of each panel can be attached to open (unsupported) edges of stud flanges first.
   1. Attach both flanges to floor runner track with screws.

F. Frame door openings to comply with GA-600 and with gypsum board manufacturer's applicable written recommendations, unless otherwise indicated. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
   1. Install two studs at each jamb, unless otherwise indicated.
   2. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint.
   3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above, even when partitions are not full height. Provide diagonal bracing at tall partitions to stop deflection and vibration of studs when doors are slammed shut.
   4. Extend jamb studs one-piece full height.

G. Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

H. Installation Tolerance: Framing members shall be within the following limits:
   1. Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing, a total variation of 1/4 inch in 8 feet from a true plane.
   2. Layout of Walls and Partitions: 1/4 inch from intended position.
   3. Plates and Runners: 1/4 inch in 10 feet from a straight line.
   4. Studs: 1/4 inch in 10 feet out of plumb, not cumulative.
   5. Headers and Sills of Openings: 1/8 inch from level across width of opening.
   6. Soffits: 1/4 inch in 10 feet from level straight line.
   7. Spacing of Framing Members: Comply with requirements of ASTM C 754.

I. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure. Install framing around structural and other members extending below floor/roof slabs and decks, as needed to support gypsum board closures and to make partitions continuous from floor to underside of solid structure.

1. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

3.5 INSTALLATION OF ACOUSTICAL INSULATION

A. Install acoustical insulation at locations indicated before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections that interfere with placement. Install insulation in voids as framing is installed that that would be inaccessible after completion of framing.

B. Install a single layer of insulation of required thickness to fill the full depth of cavity, unless otherwise shown. Where cavity requires insulation that is thicker than standard size, install next larger size and compress into cavity.

C. Hold batt insulation in place with insulation support anchors located at 5 feet on center full height of wall, starting at the top of each stud space.

D. Stuff glass fiber loose fill insulation into miscellaneous voids and cavity spaces. Fill box headers, and voids while framing is being erected that will be inaccessible for installation later. Compact to approximately 40 percent of normal maximum volume (to a density of approximately 2.5 pcf).

3.6 APPLYING AND FINISHING PANELS, GENERAL

A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216, except as specified otherwise.

B. Install acoustical insulation, where indicated, before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

C. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

D. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

E. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

F. Attachment to Steel Framing: Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

G. Attach gypsum panels to framing provided at openings and cutouts.

H. Form control and expansion joints with space between edges of adjoining gypsum panels.
   1. Where control joints are not shown, provide control joints at a maximum spacing of 30 feet; review proposed locations with Architect prior to commencement of work.

I. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect beams, open concrete coffers, joists and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by beams, joists, and other structural members; allow 1/4- to 3/8-inch-wide joints to install sealant. Caulk smoke partitions with acoustical sealant on both sides of wall to prevent the passage of smoke. Run board to within 1/4 inch of floor slabs to provide full support of resilient base.

J. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with casing bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
1. Use fire-rated acoustical sealant for fire-rated walls.

K. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
1. Space screws a maximum of 12 inches o.c. for vertical applications.

L. Space fasteners in panels that are tile substrates a maximum of 8 inches o.c.

M. Remove screws that do not hit studs, supports, or blocking.

3.7 PANEL APPLICATION METHODS

A. Single-Layer Application:
1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    a. Stagger abutting end joints not less than one framing member in alternate courses of board.
3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

B. Multilayer Application on Ceilings: Apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.

C. Multilayer Application on Partitions/Walls: Apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
1. Z-Furring Members: Apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.

D. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

E. Multilayer Fastening Methods: Fasten base layers and face layers separately to supports with screws.

F. Tile Backing Panels:
1. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch gap where panels abut other construction or penetrations.
2. Where tile backing panels abut other types of panels in the same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.8 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Install corner bead at external corners.

C. Install edge trim where edge of gypsum panels would otherwise be exposed. Provide edge trim type with face flange formed to receive joint compound, except where other types are indicated.
1. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
2. Install L-bead where edge trim can only be installed after gypsum panels are installed.
3. Install U-bead where indicated.
4. Install shadow molding where indicated.

D. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

3.9 FINISHING GYPSUM BOARD ASSEMBLIES

A. General: Treat gypsum board joints, interior angles, flanges of corner bead, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, beveled edges, and damaged surface areas using setting-type joint compound.

C. Apply joint tape over gypsum board joints and to flanges of trim accessories, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:
1. Level 1: At ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
2. Level 2: At ceiling plenum areas, concealed areas, and where indicated, for fire-resistance-rated assemblies, and smoke assemblies.
3. Level 2: Where panels are substrate for tile and where indicated.
4. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.

E. Glass-Mat, Water-Resistant Backing Panels: Finish board forming base for ceramic tile to comply with ASTM C 840 and according to manufacturer's written instructions for treatment of joints behind tile.

F. Where Level 1 gypsum board finish is indicated, embed tape in joint compound. Surface shall be free of excess joint compound.

G. Where Level 2 gypsum board finish is indicated, fill fastener heads, embed tape in joint compound and apply thin coat of joint compound over all joints and interior angles.

H. For Level 4 gypsum board finish, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration.
   1. At tapered edge joints, draw compound down to a level plane, leaving a monolithic surface that is flush with paper face. Finish coat shall be feathered a minimum of 8 inches beyond both sides of center of joint tape.
   2. At end-to-end butt joints, draw compound down to minimize hump created by joint tape application. Finish coat shall be feathered a minimum of 16 inches beyond both sides of center of joint tape.
   3. End product shall be a surface that appears level without telegraphing joint locations as high spots when viewed down wall after painting.
   4. Finish board to within 1/4 inch of floor, providing full support for resilient wall base without telegraphing joint.

3.10 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
   1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.
   2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
      a. Installation of 80 percent of lighting fixtures, powered for operation.
      b. Installation, insulation, and leak and pressure testing of water piping systems.
      c. Installation of air-duct systems.
      d. Installation of air devices.
      e. Installation of mechanical system control-air tubing.
      f. Installation of above ceiling automatic fire suppression piping, including leak and pressure testing.
      g. Installation of ceiling support framing.

3.11 CLEANING

A. Promptly remove any residual joint compound from adjacent surfaces.

3.12 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092950

SECTION 093100 - TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Glazed wall tile.
   2. Grout sealer.
   3. Metal edge strips as part of tile installations.

B. Related Sections include the following:
   1. Division 09 Section "Gypsum Board Assemblies" for glass-mat, water-resistant backer board.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product indicated.

C. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces, both floors and walls.

1.4 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain all tile of same type and color or finish from one source or producer.
   1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
   1. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient and substrate temperatures and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.
   1. Maintain temperatures at 50 deg F or more in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

B. Vent temporary heaters to exterior to prevent damage to tile work from carbon dioxide buildup.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
   1. Provide tile complying with Standard grade requirements, unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.
   1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

E. Glazed Wall Tile: Flat tile as follows:
   1. Module Size: 6 by 6 inches.
   2. Thickness: 5/16 inch.

3. Face: Plain with modified square edges or cushion edges.
4. Finish: Semi gloss, opaque.
5. Mounting: Factory back-mounted.
6. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:
    a. Base for Thin-Set Mortar Installations: Straight.
    b. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose with manufactured outside corners. Module Size 2 by 6 inches.
    c. External Corners for Thin-Set Mortar Installations: Surface bullnose, same size as adjoining flat tile.
    d. Internal Corners: Field-butted square corners. For coved base and cap use angle pieces designed to fit with stretcher shapes.
7. Products: Dal-Tile International Inc.
    a. Colors: As indicated on Materials Legend.

2.3 SETTING AND GROUTING MATERIALS

A. Manufacturers:
1. Bostik.
2. LATICRETE International Inc.
3. MAPEI Corporation.
4. TEC Specialty Products Inc.

B. Latex-Portland Cement Mortar (Thin Set) and Grout: ANSI A118.4 and ANSI A118.6 respectively, consisting of the following:
1. Prepackaged premium dry-mortar mix combined with acrylic resin liquid-latex additive.
2. For wall applications, provide nonsagging mortar that complies with Paragraph F-4.6.1 in addition to the other requirements in ANSI A118.4.
    a. Manufacturers:
        1) Bostick, Inc.
        2) Laticrete International, Inc.
        3) MAPEI Corporation.
        4) TEC Specialty Products.
3. Grout Colors: As indicated on Materials Legend; in locations not indicated, as selected by Architect from manufacturer's full range of colors.

2.4 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

C. Metal Protection Edges for Tile Walls: L-shaped profile with 1/8-inch top section and vertical wall section that together form the visible surface; profile shall have an integral trapezoidal perforated anchoring leg and an integrated grout joint spacer.
1. Material and Finish: As selected by architect from full range of finishes
2. Locations: Outside corners and as a wainscot cap.

3. Product: Schluter Systems; Schluter-Jolly.

D. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.
   1. Products:
      a. Bostik, Inc.; CeramaSeal Grout & Tile Sealer.
      b. MAPEI Corporation; KER 004, Keraseal Penetrating Sealer for Unglazed Grout and Tile.
      c. TEC; a subsidiary of H. B. Fuller Company; TA-256 Penetrating Silicone Grout Sealer.

2.5 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions, including those for accurate proportioning of materials, water, or additive content; type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortars and grouts of uniform quality with optimum performance characteristics for application indicated.

B. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
   1. Check flatness of substrate by laser.
   2. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
   3. Verify that tile backer board substrates for wall tile comply with the surface finish requirements in ANSI A108.01 for installations indicated and the following:
      a. Flatness shall not vary more than 1/4-inch in 10 feet.
      b. Verify that substrate is properly supported in corners.
      c. Verify that fasteners are properly spaced and covered.
      d. Verify that joint treatment is fully cured.
   4. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.

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

3.2 PREPARATION

A. Grind high spots and unlevelled surfaces.

B. Remove coatings that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.

C. Lay tile in patterns indicated. When field conditions conflict with indicated pattern, notify Architect in writing prior to installation for review and approval of revisions.

D. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

E. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile. Top setting of coved base is not permitted.

F. Tile shall lay flat and each edge flush with adjacent tile, free of tilting and skewed tile. Provide additional setting material to shim accent tiles that are thinner than field tiles so face is in same plane.

G. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.
   1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.

H. Grout tile to comply with requirements of the following tile installation standards:
   1. For ceramic tile grouts (latex-portland cement grouts), comply with ANSI A108.10.

3.4 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.

B. Joint Widths: Install tile on walls with the following joint widths:
   1. Glazed Wall Tile: 1/16 inch.

3.5 CLEANING AND PROTECTING

A. Remove and replace material that is stained or otherwise damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Remove latex-portland cement grout residue from tile as soon as possible.
   2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

C. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

D. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

E. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION 093100

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Acoustical panels.
   2. Exposed suspension systems.

B. Related Sections include the following:
   1. Division 22, 23and 26 Sections for coordination of air handling devices, fire protection devices, and electrical devices installed in ceiling systems.

1.3 DEFINITIONS

A. CAC: Ceiling Attenuation Class.

B. NRC: Noise Reduction Coefficient.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes. Store materials flat.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.6 PROJECT CONDITIONS

A. Mechanical, electrical, and other utility service installations above the ceiling plane shall have been completed prior to the installation of the ceilings.

1.7 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
   1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.
   2. Test Method for Ceiling Attenuation Class (CAC). Where acoustical panel ceilings are specified to have a CAC, provide units identical to those tested per ASTM E 1414 by a qualified testing agency.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

2.2 ACOUSTIC PANELS

A. Acoustic Panel: ACT-1.
   1. Size: 24 inches x 24 inches by 5/8 inch thick.
   2. Composition: Mineral wool fiber.
   3. Surface Finish: Factory-applied latex paint; white.
   4. Surface Texture: Medium.
   5. Edge: Angled tegular.
   6. NRC Range: .55.
   7. CAC Range: 33.
   8. Fire Hazard Classification: Class A, 0 - 25 flame spread.
   9. Dimensional Stability: Sag resistant at high humidity.
   10. Antimicrobial Treatment: Coating based, front and back.
   11. Product: Armstrong World Industries, Inc.; Cortega #704.

2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.
   1. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory

devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
   2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106 inch diameter wire.

2.4 METAL SUSPENSION SYSTEMS FOR ACOUSTICAL PANEL CEILINGS

A. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation, with prefinished 15/16 inch wide metal caps on flanges.
   1. Structural Classification: Intermediate-duty system.
   2. End Condition of Cross Runners: Override (stepped) or butt-edge type, as standard with manufacturer.
   3. Face Design: Flat, flush.
   4. Cap Material: Steel or aluminum cold-rolled sheet, as standard with manufacturer.
   5. Cap Finish: Painted white.
   6. Product: Armstrong World Industries, Inc.; Prelude Exposed Tee System, 7300 Series.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

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

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION, GENERAL

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Hangers shall be single lengths of wire without splices; coordinate lengths in deep ceiling cavities.
2. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
3. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. Do not attach hangers to steel deck tabs.
8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
9. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
10. Exposed pop rivets for grid alignment purposes shall not be permitted.

C. Suspension system shall be reinforced to support diffusers, light fixtures and any additional members. Install hanger wires to grid at each corner of light fixtures. Coordinate location with electrical and other trades.
1. Each individual fixture and attachment with combined weight of 56 pounds or less shall have two 12 gage wire hangers attached at diagonal corners of the fixture. These wires shall be slack. Fixtures and attachments with a combined weight of greater than 56 pounds shall be independently supported from the structure at all four corners.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. Arrange directionally patterned acoustical panels to run in the same direction.
2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.

3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.4 INSTALLATION OF DECORATIVE ALUMINUM TRIM

A. General: Install in accordance with the manufacturer's written instructions.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

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SECTION 096500 - RESILIENT FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Resilient wall base, reducer strips, and other accessories.

B. Related Sections include the following:
   1. Division 02 Section "Selective Demolition and Alterations" for removing existing finishes.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product indicated. Include printed statement of VOC content for adhesives.

C. Samples: For each type of product indicated. Samples shall be in form of manufacturer's color charts consisting of the following:
   1. Resilient Accessories: Color charts consisting of strips of resilient base showing the full range of colors available for each product exposed to view.

D. Product Certifications: Signed by resilient flooring manufacturer of products supplied that products comply with specifications and local regulations controlling use of volatile organic compounds (VOC's).
   1. Flooring manufacturers shall certify that proposed adhesives are acceptable for use with each type of floor covering.

E. Maintenance Data: For resilient products to include in maintenance manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver resilient flooring materials and installation accessories to Project site in original manufacturer's unopened cartons and containers each bearing name of product and manufacturer, Project identification, and shipping and handling instructions.

B. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store tiles on flat surfaces and rolls upright.

C. Move flooring materials and accessories and installation products into spaces where they will be installed at least 48 hours in advance of installation. Do not install flooring materials until they are at same temperature as space where they are to be installed.

1.5 PROJECT CONDITIONS

A. Maintain ambient and substrates temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive floor tile during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor covering installation and for 48 hours after floor covering installation.

1.6 SEQUENCING AND SCHEDULING

A. Install resilient products after other finishing operations, including painting, have been completed.

B. Contractor to coordinate project schedule to complete work by other trades and vacate areas receiving floor coverings, stopping pedestrian traffic over newly installed flooring until curing and drying period is complete. Contractor to conduct periodic coordination meetings with all trades to review schedule and procedures to prevent interference and damage during installation and curing and drying periods of floor coverings.

PART 2 - PRODUCTS

2.1 RESILIENT WALL BASE

A. Wall Base: ASTM F 1861.
   1. Manufacturers: Rubber Wall Base; Johnsonite.

B. Type (Material Requirement): TS (rubber, vulcanized thermoset).

C. Group (Manufacturing Method): I (solid).

D. Style: Cove (with top-set toe).

E. Minimum Thickness: 0.125 inch.

F. Height: 6 inches.

G. Lengths: Coils in manufacturer's standard length.

H. Outside Corners: Premolded.

I. Inside Corners: Job formed.

J. Surface: Smooth.

K. Color: As indicated in Materials Legend.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. If conditions detrimental to work are encountered, prepare written report, signed by Installer, documenting unsatisfactory conditions and send to the Architect.

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

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

B. Concrete Substrates: Verify that concrete slabs comply with ASTM F 710 and the following:
   1. Verify that substrates are dry and free of curing compounds, sealers, hardeners, and other materials whose presence would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by manufacturer, and with the specified requirements.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
   1. Do not install resilient products until they are same temperature as space where they are to be installed.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 RESILIENT WALL BASE INSTALLATION

A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required. Provide on fronts and exposed sides and backs of floor-mounted casework. Where toe space is less than base height, cut down base to proper height.

B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

D. Do not stretch wall base during installation.

E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.

F. Job-Formed Corners: Provide job-formed corners everywhere, except as noted, as follows:
   1. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.
   2. Adhere base to substrate with contact adhesive 12 inches each side of outside corner to properly hold base in permanent proper position in tight contact with wall. Base shall run continuous around corners with butt joints 12 inches minimum for corner.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing installation of resilient floor accessories:
   1. Remove adhesive and other blemishes from exposed surfaces using cleaner recommended by resilient floor coverings manufacturers.
   2. Sweep and vacuum surfaces thoroughly.

B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

END OF SECTION 096500

SECTION 099000 - PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Exposed exterior items and surfaces with low VOC coatings complying with ME DEP regulations (OTC regulations).
   2. Exposed interior items and surfaces with low VOC coatings complying with ME DEP regulations (OTC regulations).
   3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Related Sections include the following:
   1. Division 04 Section "Unit Masonry Assemblies" for preparation of concrete masonry.
   2. Division 05 Section "Structural Steel Framing" for shop priming structural steel.
   3. Division 05 Section "Steel Decking" for shop finish on metal deck to be field finished.
   4. Division 05 Section "Metal Fabrications" for shop priming ferrous metal.
   5. Division 06 Section "Architectural Woodwork" for surface preparation of counter brackets and for shop finishing of architectural woodwork.
   6. Division 08 Section "Hollow Metal Doors and Frames" for factory priming steel doors and frames.
   7. Division 09 Section "Gypsum Board Assemblies" for surface preparation of gypsum board.
   8. Division 09 Section “Elastomeric Coatings” for Exterior Coating.
   9. Review all sections for shop primed items requiring field painting.

1.3 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
   1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
   2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
   3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
   4. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
   5. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each paint system indicated. Include block fillers and primers.
   1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
   2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
   3. Include printed statement of VOC content for each product.

C. Schedule: Provide schedule of all surfaces to be coated, with prime and finish coat material listed, and manufacturer's recommended wet film thickness.

D. Samples: For each type of exposed finish required, submit color chips, 3- by 5-inches, matching colors indicated on Materials Legend.

E. Manufacturer Certificates: Signed by manufacturers certifying that products with limit VOC amounts specified comply with requirements.

F. Qualification Data: For Applicator.

G. Color Mix Code: For all colors used for Project to include in Owner's Manual.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced Applicator who has completed painting system applications similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers, primers and undercoat materials for each coating system from the same manufacturer as the finish coats.

C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample for each type of coating and substrate required. Duplicate finish of approved sample Submittals.
   1. Architect will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted.
      a. Wall Surfaces: Provide samples of at least 100 sq. ft.
      b. Floor Surfaces: Provide samples of at least 25 sq. ft.
      c. Small Areas and Items: Architect will designate items or areas required.
   2. After permanent lighting and other environmental services have been activated, apply benchmark samples, according to requirements for the completed Work. Provide required sheen, color, and texture on each surface.
      a. After finishes are accepted, Architect will use the room or surface to evaluate coating systems of a similar nature.
   3. Final approval of colors will be from benchmark samples.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
   1. Product name or title of material.

2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
1. Protect from freezing. Keep storage area neat and orderly.
2. Remove oily rags and waste daily.
3. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.7 PROJECT CONDITIONS

A. Apply paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.

B. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.
2. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before proceeding with or continuing coating operation.

1.8 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
1. Quantity: Furnish Owner with not less than 1 gal., of each material and color applied for Owner's use during move in.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

B. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
1. Benjamin Moore & Company (Moore).
2. Samuel Cabot, Inc. (Cabot).
3. Great Lakes Laboratories (GLL).
4. PPG Architectural Finishes, Inc. (PPG).
5. Sherwin-Williams Co. (S-W).

6. Tnemec Company, Inc. (Tnemec).
7. Flame Control Coatings, LLC (Flame Control); phone: (716) 282-1399; available through Sherwin-Williams.

2.2 COATINGS MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best quality coating material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers listed in the specification schedule. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
2. Where schedule says no substitution, use proprietary product only. Do not propose substitution, as the products from the other manufacturers have been considered, and are not acceptable.

C. VOC Compliance for Exterior and Interior Paints and Coatings: Provide the manufacturer's formulation for the products specified below that are VOC compliant with the State of Maine Department of Environmental Protection Regulation, "Chapter 151: Architectural and Industrial Maintenance (AIM) Coatings" and the following chemical restrictions from the Ozone Transport Commission (OTC) expressed in grams per liter:
1. Flat Paints and Coatings: VOC content of not more than 100 g/L.
2. Non-Flat Paints and Coatings: VOC content of not more than 150 g/L.
3. Non-Flat Paints and Coatings - High Gloss: VOC content of not more than 250 g/L.
4. Anticorrosive (Rust Preventative) Coatings: VOC content of not more than 400 g/L.
5. Clear Wood Coatings:
    a. Varnishes: VOC content of not more than 350 g/L.
6. Fire Retardant Coatings:
    a. Clear: VOC content of not more than 650 g/L.
    b. Opaque: VOC content of not more than 350 g/L.
7. Industrial Maintenance Coatings (IMC): VOC content of not more than 340 g/L.
8. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
9. Quick-Dry Enamels: VOC content of not more than 250 g/L.
10. Quick-Dry Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
11. Specialty Primers, Sealers, and Undercoaters: VOC content of not more than 350 g/L.
12. Stains: VOC content of not more than 500 g/L.
13. Wood Preservatives: VOC content of not more than 350 g/L.

D. Colors: Provide colors as indicated in Materials Legend; if color is not indicated, color shall be as selected by the Architect from the manufacturer's full range of options.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator and drywall subcontractor present, under which painting will be performed for compliance with paint application requirements.
   1. Inspect walls for dents and imperfections prior to painting. Inspect walls again after primer and first coat of paint applied, with Applicator and drywall subcontractor present. Drywall subcontractor shall touch-up as follows:
      a. Touch-up visible gypsum board imperfections before priming of walls.
      b. Touch-up imperfections found in field of boards and joints made visible from painting after first finish coat applied.
   2. If unacceptable conditions are encountered, prepare written report, endorsed by Applicator, listing conditions detrimental to performance of work.
   3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
   4. Application of coating indicates Applicator's acceptance of surfaces and conditions within a particular area.
   5. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of specified finish materials to ensure use of compatible primers.
   1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
   1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
   1. Provide barrier coats over incompatible primers or remove and reprime.
   2. Cementitious Materials: Prepare concrete and concrete unit masonry surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze.
      a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
      b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and

burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.

c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry and vacuum before painting.

d. Fill cracks, voids, bug holes and joints with appropriate filler.

3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
   a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer.
   b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood.
   c. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
   d. If transparent finish is required, backprime with spar varnish.
4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's standards.
   a. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
   b. Touch up bare areas and shop-applied prime coats that have been damaged. Clean with solvents recommended by paint manufacturer and SSPC SP2; and touch up with same primer as the shop coat.
5. Galvanized Surfaces: Uniformly abrade galvanized surfaces with a palm sander and 60 grit aluminum oxide so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
   a. Clean field welds with nonpetroleum-based solvents complying with SSPC's standards so surface is free of oil and surface contaminants.
6. Metal Doors and Frames: Wipe down to remove oils and surface contaminates during shipping and installation.

D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
   1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
   2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
   3. Use only thinners approved by paint manufacturer and only within recommended limits.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
   1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
   2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
   3. Provide finish coats that are compatible with primers used.

4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces, unless indicated otherwise.
9. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer over metal surfaces that have been shop primed and touchup painted, unless otherwise indicated.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

C. Paint all exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.
1. Painting includes field painting of exposed bare and covered pipes and ducts (including color-coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment at all locations, except mechanical and electrical rooms.

D. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
1. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

E. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions. Walls shall have roller finish.

1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

F. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

G. Mechanical and Electrical Work: Painting of mechanical, plumbing, fire protection, and electrical work is limited to items exposed in occupied spaces (outside mechanical and electrical rooms).

H. Mechanical, plumbing, and fire protection items to be painted include, but are not limited to, the following:
1. Piping, pipe hangers and supports.
2. Heat exchangers.
3. Tanks.
4. Ductwork, including interior of ductwork visible through air devices.
5. Insulation.
6. Accessory items.

I. Electrical items to be painted include, but are not limited to, the following:
1. Conduit and fittings.
2. Panelboards.

J. Block Fillers: Apply block fillers to concrete masonry units at a rate to ensure complete coverage with pores filled.

K. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

L. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

M. Transparent (Clear or Stained) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
1. Provide satin finish for final coats, unless otherwise noted.

N. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

O. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

P. Exterior Ferrous Metal Items to Be Painted Include, but Are Not Limited To, the Following:
1. Exposed structural steel and lintel plates.
a. Galvanized single angle lintels do not require painting, except as noted otherwise.
1) Galvanized angle lintels at main entrance shall be painted.
2. Steel doors and frames.
3. Bollards.
4. Metal fabrications; see Division 05 Section "Metal Fabrications."
5. Factory primed louvers.
6. Miscellaneous metal items, including galvanized steel.

Q. Interior Ferrous Metal Items to Be Painted Include, but Are Not Limited To, the Following:
1. Steel doors and frames.
2. Steel stairs, including risers and stringers.
3. Handrails and guardrails.
4. Lintel plates and angles.
5. Exposed construction, including metal deck.
6. Access panels (both sides).
7. Metal fabrications; see Division 05 Section "Metal Fabrications."
8. Miscellaneous metal items.

3.4 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the Project site.
1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.5 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINT SCHEDULE

A. VOC Compliance, General: Provide the manufacturers' formulations for the products specified below that comply with the VOC requirements for the State of Maine Department of Environmental Protection in paragraph 2.2.C of this Section.

B. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items, except steel doors and frames, which require a primer under this specification.
1. Semigloss, Waterborne Alkyd Finish: 2 finish coats over a primer.

a. Primer: Quick-drying, corrosion resistant, single component, acrylic-modified alkyd metal primer applied to galvanized metals not previously shop-primed applied at spreading rate recommended by the manufacturer to achieve a dry film thickness of not less than indicated for product. Moore and S-W do not have exterior products meeting requirements.
   1) PPG: Speedhide 6-208 Interior/Exterior Rust Inhibitive Steel Primer; 2.3 mils DFT.

b. First and Second Coats: Semigloss, exterior, single component, waterborne alkyd applied at spreading rate recommended by the manufacturer to achieve a dry film thickness per coat of not less than indicated for product. Moore does not have exterior products meeting requirements; S-W ProMar 200 Interior Waterbased Acrylic-Alkyd not approved for exterior use.
   1) PPG: Speedhide Interior/Exterior WB Alkyd Semi-Gloss 6-1510 Series; 1.5 mils DFT per coat.

C. Zinc-Coated Metal: Provide the following finish systems over exterior zinc-coated (galvanized) metal surfaces: Primer is not required on shop-primed items, except zinc-coated (galvanized) steel doors and frames, which require a primer under this specification.
1. Semigloss, Waterborne Alkyd Finish: 2 finish coats over a primer.
   a. Primer: Quick-drying, corrosion resistant, single component, acrylic-modified alkyd metal primer applied to galvanized metals not previously shop-primed applied at spreading rate recommended by the manufacturer to achieve a dry film thickness of not less than indicated for product. Moore and S-W do not have exterior products meeting requirements.
      1) PPG: Speedhide 6-209 Interior/Exterior Galvanized Steel Primer; 1.8 mils DFT.
   b. First and Second Coats: Semigloss, exterior, single component, waterborne alkyd applied at spreading rate recommended by the manufacturer to achieve a dry film thickness per coat of not less than indicated for product. Moore does not have exterior products meeting requirements; S-W ProMar 200 Interior Waterbased Acrylic-Alkyd not approved for exterior use.
      1) PPG: Speedhide Interior/Exterior WB Alkyd Semi-Gloss 6-1510 Series; 1.5 mils DFT per coat.

3.7 LOW VOC INTERIOR COATINGS

A. VOC Compliance, General: Provide the manufacturers' formulations for the products specified below that comply with the VOC requirements for the State of Maine Department of Environmental Protection in as defined in paragraph 2.2.C of this Section.

B. Concrete Masonry Units: Provide the following finish systems over interior concrete masonry block units:
1. Semigloss, Waterborne Epoxy Finish (Walls): 2 finish coats over a block filler.
   a. Block Filler: High-performance, latex-based, block filler applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
      1) Moore: Latex Block Filler No. M88; 8.0 mils DFT.
      2) PPG: Speedhide 6-15 Interior/Exterior Masonry Hi Fill Latex Block Filler; 8.0 mils DFT.
      3) S-W: PrepRite Block Filler B25W25; 8.0 mils DFT.

b. First and Second Coats: Semigloss, waterborne or acrylic based epoxy finish applied at spreading rate recommended by the manufacturer to achieve a dry mill thickness per coat of not less than indicated for product.
   1) Moore: Super Spec HP Acrylic Epoxy Coating No. KP43; 1.5 mils DFT per coat.
   2) PPG: Pitt-Glaze WB1 16-510 Interior Semi-Gloss Pre-Catalyzed Water-borne Acrylic Epoxy; 1.5 mils DFT per coat.
   3) S-W: Pro Industrial Pre-Catalyzed Waterbased Epoxy No. K46-150 Series; 1.5 mils DFT per coat.

C. Concrete Floor: Provide the following finish system over interior concrete floor slab:
   1. Two-Component Heavy Duty Epoxy Floor Coating at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
      a. First and Second Coats:
         1) S-W: ArmorSeal 1000 HS Epoxy, B67-2000 Series

D. Gypsum Board: Provide the following finish systems over interior gypsum board:
   1. Semigloss, Waterborne Epoxy Finish (Walls): 2 finish coats over a primer.
      a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a dry film thickness of not less than indicated for product.
         1) Moore: Fresh Start All-Purpose 100% Acrylic Primer No. N023; 1.3 mils DFT.
         2) PPG: Speedhide Interior MaxPrime Latex Primer/Surfacer 6-4; 1.0 mils DFT.
         3) S-W: ProMar 200 Interior Latex Flat, B30W200 Series; 1.5 mils DFT.
      b. First and Second Coats: Semigloss, waterborne or acrylic based epoxy finish applied at spreading rate recommended by the manufacturer to achieve a dry mill thickness per coat of not less than indicated for product.
         1) Moore: Super Spec HP Acrylic Epoxy Coating No. KP43; 1.5 mils DFT per coat.
         2) PPG: Pitt-Glaze WB1 16-510 Interior Semi-Gloss Pre-Catalyzed Water-borne Acrylic Epoxy; 1.5 mils DFT per coat.
         3) S-W: Pro Industrial Pre-Catalyzed Waterbased Epoxy No. K46-150 Series; 1.5 mils DFT per coat.

E. Wood Trim, Opaque Finish: Provide the following paint finish systems over new, interior wood surfaces:
   1. Semigloss, Acrylic-Latex Finish, Trim: 2 finish coats over a wood undercoater/primer.
      a. Primer: Low VOC, stain-blocking, acrylic-latex-based, interior wood undercoater, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
         1) Moore: Fresh Start High-Hiding All-Purpose Primer No. 056; 1.4 mils DFT.
         2) PPG: Speedhide 6-2 Interior Latex Sealer Quick-Drying; 1.0 mils DFT.
         3) S-W: Premium Wall & Wood Primer B28W08111 Series; 1.8 mils DFT.

b. First and Second Coats: Low odor, low VOC, semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a dry film thickness per coat of not less than indicated for product.
   1) Moore: Ben Premium Interior Latex Semi-Gloss No. W627; 1.5 mils DFT per coat.
   2) PPG: Speedhide Interior High Lustre Semi-Gloss Latex, 6-8510 Series; 1.2 mils DFT per coat.
   3) S-W: ProGreen 200 Low VOC Interior Latex Semi-Gloss B31W2200 Series; 1.6 mils DFT per coat.

F. Ferrous Metal: Provide the following finish systems over ferrous metal. Primer is not required on shop-primed items, except steel doors and frames, which require a primer under this specification. Prime bare spots and cracks on other ferrous metals.
1. Semigloss, Acrylic-Modified Alkyd Finish or Pre-Catalyzed Waterborne Acrylic Epoxy Finish, All Surfaces except Handrails: 2 finish coats over a primer.
   a. Primer: Quick-drying, corrosion resistant, single component, acrylic-modified alkyd primer or self cross-linking acrylic primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a ry film thickness of not less than indicated for product.
      1) Moore: Advance Waterborne Interior Alkyd Primer No. 790; 1.6 mils DFT.
      2) PPG: Pitt-Tech Plus 90-912 Interior/Exterior Industrial DTM Primer; 3.0 mils DFT.
      3) S-W: Pro Industrial Pro-Cryl Universal Primer B66-310 Series; 3.0 mils DFT.
   b. First and Second Coats: Semigloss, single component, acrylic-modified alkyd interior enamel or single-component, pre-catalyzed waterborne acrylic epoxy applied at spreading rate recommended by the manufacturer to achieve a dry film thickness per coat of not less than indicated for product.
      1) Moore: Advance Waterborne Interior Alkyd Gloss No. 794; 1.6 mils DFT per coat.
      2) PPG: Pitt-Glaze WB1 16-510 Interior Semi-Gloss Pre-Catalyzed Water-Borne Acrylic Epoxy; 2.0 mils DFT per coat.
      3) S-W: Pro Industrial Pre-Catalyzed Waterbased Epoxy K45-150 Series; 1.5 mils DFT per coat.
2. Semigloss, Water Based Epoxy Enamel Finish, Handrails: 2 finish coats over shop applied primer.
   a. First and Second Coats: Semigloss, waterborne epoxy or polyamine epoxy finish applied at spreading rate recommended by the manufacturer to achieve a dry mill thickness per coat of not less than indicated for product.
      1) Moore: Waterborne Polyamide Epoxy Gloss Coating No. P42; 3.0 mils DFT per coat.
      2) PPG: Pitt-Glaze WB1 16-510 Interior Semi-Gloss Pre-Catalyzed Water-Borne Acrylic Epoxy; 2.0 mils DFT per coat.
      3) S-W: Pro Industrial Pre-Catalyzed Waterbased Epoxy K45-150 Series; 1.5 mils DFT per coat.

G. Zinc-Coated Metal: Provide the following finish systems over zinc-coated metal. Primer is not required on shop-primed items, except zinc-coated steel doors and frames, which require a primer under this specification. Prime bare spots and cracks on other zinc-coated metals.

1. Semigloss, Acrylic-Modified Alkyd Finish or Pre-Catalyzed Waterborne Acrylic Epoxy Finish: 2 finish coats over a primer.
    a. Primer: Quick-drying, corrosion resistant, single component, acrylic-modified alkyd primer or self cross-linking acrylic primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a dry film thickness of not less than indicated for product.
        1) Moore: Advance Waterborne Interior Alkyd Primer No. 790; 1.6 mils DFT.
        2) PPG: Speedhide 6-209 Interior/Exterior Galvanized Steel Primer; 3.6 mils DFT.
        3) S-W: Pro Industrial Pro-Cryl Universal Primer B66-310 Series; 3.0 mils DFT.
    b. First and Second Coats: Low VOC, semigloss, single component, acrylic-modified alkyd interior enamel or single-component, pre-catalyzed waterborne acrylic epoxy applied at spreading rate recommended by the manufacturer to achieve a dry film thickness per coat of not less than indicated for product.
        1) Moore: Advance Waterborne Interior Alkyd Gloss No. 794; 1.6 mils DFT per coat.
        2) PPG: Speedhide 6-1510 Series Interior/Exterior WB Alkyd Semi-Gloss; 1.5 mils DFT per coat.
        3) S-W: Pro Industrial Pre-Catalyzed Waterbased Epoxy K45-150 Series; 1.5 mils DFT per coat.

H. Overhead Exposed Construction, Including Metal Deck, Steel Joists, Galvanized Duct Work and Piping: Provide the following finish system.
    1. Flat, Modified Alkyd Rust-Inhibitive Primer/Finish: Quick-drying, corrosion resistant, primer/finish over prepaint surface cleaner.
        a. Prepaint Surface Cleaner: Concentrated alkaline detergent blend for cleaning overhead construction without needing to rinse prior to coating, applied at spreading rate recommended by the manufacturer.
            1) GLL: No Rinse Prepaint Cleaner.
        b. Primer/Finish: Quick-drying, corrosion resistant, primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a dry film thickness of not less than indicated for product.
            1) Tnemec: Series 115, Uni-Bond DF; 3.0 mils DFT. No substitution.

I. Telecommunication, Data and Electrical Backboards: Provide the following finish over plywood:
    1. Flat Intumescent Finish: Two finish coats over a primer.
        a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a dry film thickness of not less than indicated for product.
            1) Moore: Fresh Start High-Hiding All-Purpose Primer No. 056; 1.4 mils DFT.
            2) SW: Preprite Problock Interior/Exterior Latex Primer\Sealer; 1.4 mils DFT.
        b. First and Second Coats: Intumescent-type, fire-retardant paint applied at spreading rate recommended by manufacturer to achieve a total dry film thickness of not less than 4 mils; white color for telecommunication and black for electrical.
            1) Moore: P59 220 Latex Fire-Retardant Coating.
            2) FlameControl: 20-20A Flat Latex Intumescent Coating.

J. Smoke and Fire-Rated Partition Identification: Identify all smoke partitions and all fire-rated walls and partitions by stenciling "X-HOUR FIRE WALL", where "X" is the hourly rating; provide on each side of rated walls above ceiling line with 4 inch high letters in red or orange semigloss paint; each rated wall shall be identified with fire rating of wall at least once and at a spacing not greater than 12 feet o.c. and not more than 5 feet from each end of the wall. Identify all smoke barriers and partitions by stenciling “SMOKE” on each side of walls above ceiling line with 4 inch high letters in bright green semigloss paint; each rated wall shall be identified at least once and at a spacing not greater than 12 feet o.c. and not more than 5 feet from each end of wall.

1. First Coat: Low odor, zero VOC, semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a dry film thickness of not less than indicated for product.
    a. Moore: Ben Premium Interior Latex Semi-Gloss No. W627; 1.5 mils DFT.
    b. PPG: Speedhide Interior High Lustre Semi-Gloss Latex, 6-8510 Series; 1.2 mils DFT.
    c. S-W: ProGreen 200 Interior Latex Semi-Gloss B31W2200 Series; 1.6 mils DFT.

END OF SECTION 099000

SECTION 099653 - ELASTOMERIC COATING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Exposed exterior items and surfaces. Provide labor, materials, equipment and supervision necessary to complete the application of product to existing substrate.
   2. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Related Sections include the following:
   1. Division 04 Section "Clay Masonry Restoration and Cleaning" for preparation of concrete masonry and brick.
   2. Division 07 Section “Joint Sealants” for sealing of joints greater than tolerances of elastomeric coating system.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data:
   1. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.

C. Samples: Submit color chips, 3- by 5-inches, matching colors indicated on drawings.

D. Qualification Data: For Applicator:
   1. The trained applicator shall submit to the specifier a list of five projects that he has completed within the last five years, exhibiting the applicator’s skills. The list shall include project name, location, and description of work and completion date.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced Applicator who has completed coating system applications similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample for each type of coating and substrate required. Duplicate finish of approved sample Submittals.
   1. Architect will select surface to represent surfaces and conditions for each type of substrate to be coated.
      a. Wall Surfaces: Provide samples of at least 100 sq. ft.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
   1. Product name or title of material.
   2. Product description (generic classification or binder type).
   3. Manufacturer's stock number and date of manufacture.
   4. Contents by volume, for pigment and vehicle constituents.
   5. Thinning instructions.
   6. Application instructions.
   7. Color name and number.
   8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
   1. Protect from freezing. Keep storage area neat and orderly.
   2. Remove oily rags and waste daily.
   3. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.6 PROJECT CONDITIONS

A. Apply coating only when temperatures of surfaces to be coated and surrounding air are between 45 and 95 deg F.

B. Do not apply coating in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
   1. Coating may continue during inclement weather if surfaces and areas to be coated are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.
   2. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before proceeding with or continuing coating operation.

1.7 EXTRA MATERIALS

A. Furnish extra coating materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
   1. Quantity: Furnish Owner with not less than 5 gal., of each material and color applied for Owner's use during move in.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer:
   1. Conproco Corporation

2.2 MATERIALS

A. Conpro Lastic: Waterproof elastomeric crack bridging, anti-carbonation membrane for vertical exterior surfaces.

2.3 COATINGS MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

PART 3 - EXECUTION

3.1 GENERAL

A. Examine substrates, areas, and conditions, with Applicator under which coating will be performed for compliance with paint application requirements.
   1. If unacceptable conditions are encountered, prepare written report, endorsed by Applicator, listing conditions detrimental to performance of work.
   2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
   3. Application of coating indicates Applicator's acceptance of surfaces and conditions within a particular area.
   4. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
   5. Coordinate installation with adjacent work to ensure proper sequence of construction. Protect adjacent areas and landscaping from contact due to mixing, handling, and application of materials.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of specified finish materials to ensure use of compatible primers.
   1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying coating or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
   1. Schedule cleaning and coating so dust and other contaminants from the cleaning process will not fall on wet, newly coated surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
   1. Provide barrier coats over incompatible primers or remove and reprime.
   2. Prepare concrete unit masonry and brick surfaces to be coated. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze.
      a. High Pressure Wash: High pressure wash entire surface to be coated. Protect all adjacent items from possible damage. Contractor shall be responsible for complying with all environmental regulations regarding clean up.
      b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish coating to blister and burn, correct this condition before application. Do not coat surfaces if moisture content exceeds that permitted in manufacturer's written instructions.

D. Material Preparation: Mix and prepare coating materials according to manufacturer's written instructions.
   1. Maintain containers used in mixing and applying coating in a clean condition, free of foreign materials and residue.
   2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
   3. Mix with low-speed mixer until homogeneous. Do not use high-speed mixer or over mix.

3.3 APPLICATION

A. Apply with a heavy nap roller (1 1/4” synthetic nap roller) or a commercial airless paint sprayer (Graco 3500, President or Bulldog with a 0.041 – 0.047 tip with smooth texture). If rolled, use a roller screen to provide an even amount on the roller.

B. Apply to a minimum of 15 mils. Wet thickness per coat to achieve a continuous pinhole-free membrane. Backroll material to eliminate pinholes, if necessary.

C. Coating shall be applied in one continuous operation, maintaining a wet edge. Terminate coats at a natural break such as an outside or inside corner if one continuous coat is not possible.

D. Sufficient manpower, scaffolding and equipment shall be provided to ensure a continuous and uniform application.

E. Protect until fully cured from airborne contamination, (dirt, dust, soot, etc.) weather and other damage.

F. Provide a test sample of the material to determine coverage rate and adhesion. Test adhesion after the coating has cured for 24 hours by using a knife to cut a crosshatch pattern (#). Use the tip of the knife to pull the edge of the coating from the substrate. If the coating comes off over half of the squares the adhesion is not adequate. If the adhesion is not adequate reapply to a new area according to manufacturer’s instructions.

G. Protect from moisture for 24 hours and wind driven rain for 72 hours.

3.4 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the Project site.
   1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.
   2. Clean all adjacent surfaces and materials. Cured materials must be removed mechanically.

3.5 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
   1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 099653

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SECTION 101100 - VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Markerboards.
   2. Tackboards.

B. Related Sections include the following:
   1. Division 06 Section "Rough Carpentry" for concealed wood blocking required for installation of boards.

1.3 DEFINITIONS

A. Tackboard: Framed or unframed tackable surface.

B. Visual Display Boards: Markerboards and tackboards that is factory fabricated into composite panel form, with a perimeter frame.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   1. Adhesives: Include documentation indicating that adhesives comply with VOC requirements.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Show location of panel joints.
   2. Include sections of typical trim members.

D. Product Schedule: For visual display surfaces. Use same designations indicated on Drawings.

E. Samples for Initial Selection: For each type of visual display surface indicated and as follows:
   1. Actual sections of porcelain-enamel face sheet, tack assembly, and visual display fabric.

F. Maintenance Data: For visual display surfaces to include in maintenance manuals.
   1. Include precautions for cleaning materials and methods that could be detrimental to surfaces.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of visual display surface through one source from a single manufacturer.
   1. Markerboards and tackboards shall be manufactured by same manufacturer.

B. Fire-Test-Response Characteristics: Provide fabrics with the surface-burning characteristics indicated, as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-built visual display boards, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.

B. Store visual display units vertically with packing materials between each unit.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display surfaces until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Product: Subject to compliance with requirements, provide product specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 MATERIALS, GENERAL

A. Porcelain-Enamel Face Sheet: Porcelain-enamel-clad, ASTM A 463/A 463M, Type 1, stretcher-leveled aluminized steel, with 0.0236-inch uncoated thickness; with porcelain-enamel coating fused to steel at approximately 1000 deg F.
   1. Gloss Finish: As selected by Architect; dry-erase markers wipe clean with dry cloth or standard eraser.

B. Hardboard: AHA A135.4, tempered.

C. Particleboard: ANSI A208.1, Grade 1-M-1.

D. Fiberboard: ANSI A208.2, Grade MD.

E. Cork Sheet: MS MIL-C-15116-C, Type II

F. Natural Cork Sheet: Seamless, single layer, compressed fine-grain cork sheet, bulletin board quality; face sanded for natural finish.

G. Polyester Fabric: Nondirectional weave, 100 percent polyester; weighing not less than 15 oz./sq. yd.; with flame-spread index of 25 or less when tested according to ASTM E 84.

H. Extruded Aluminum: ASTM B 221, Alloy 6063.

I. Adhesive: Manufacturer's standard product for use with specific substrate application.
   1. Adhesive shall have a VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MARKERBOARDS

A. Porcelain-Enamel Markerboard: Balanced, high-pressure, factory-laminated markerboard assembly of 3-ply construction consisting of backing sheet, core material, and 0.024-inch- thick (24 gage), porcelain-enamel face sheet; dry-erase markers wipe clean with dry cloth or standard eraser.
   1. Manufacturers:
      a. Claridge Products & Equipment, Inc.
      b. Newline Products, Inc.
      c. K-Pro Specialty Products.
   2. Particleboard Core: 3/8 inch thick; with 0.005-inch- thick, aluminum foil backing.
   3. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.
   4. Accessories: Clear anodized, extruded aluminum trim and chalk trough, and full length one inch wide map rail with cork insert with two metal map hooks for every six feet of marker board.
   5. Sizes: As indicated.
   6. Color and Gloss Level: As selected by Architect.

2.4 TACKBOARDS

A. Manufacturers:
   1. Claridge Products & Equipment, Inc.
   2. Newline Products, Inc.
   3. K-Pro Specialty Products.

B. Polyester-Fabric-Faced Tack Assembly: 1/4-inch- thick, polyester-fabric-faced cork sheet factory laminated to 1/4-inch- thick hardboard or plywood backing.
   1. Color: As selected by Architect from manufacturer's full range of options.

C. Frame: Clear anodized, extruded aluminum trim to match marker boards.

2.5 MARKERBOARD AND TACKBOARD ACCESSORIES

A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- thick, extruded aluminum; of size and shape indicated.
   1. Factory-Applied Trim: Manufacturer's standard with no visible screw or exposed joints.

B. Chalktray: Manufacturer's standard, continuous.
   1. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.

C. Map Rail: Provide the following accessories:
   1. Display Rail: Continuous and integral with map rail; fabricated from cork approximately 1 to 2 inches wide.
   2. End Stops: Located at each end of map rail.
   3. Map Hooks and Clips: Two map hooks with flexible metal clips for every 72 inches of map rail or fraction thereof.
   4. Flag Holder: One for each room.

2.6 FABRICATION

A. Porcelain-Enamel Markerboards: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.

B. Factory-Assembled Markerboards and Tackboards: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.
   1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
   2. Provide manufacturer's standard vertical-joint H-trim system between abutting sections of markerboards.
   3. Provide manufacturer's standard mullion trim at joints between markerboards and tackboards of combination units.

C. Aluminum Frames and Trim for Markerboards and Tackboards: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to neat, hairline closure.
   1. Trim shall be assembled and attached at manufacturer's factory before shipment.

2.7 ALUMINUM FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

D. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance.
   1. If unacceptable conditions are encountered, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine walls and partitions for proper backing and blocking for markerboards and tackboards.

C. Failure to report defects, if any, will be construed as acceptance of work as executed and will release those responsible for faulty workmanship.

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

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Remove dirt, scaling paint, projections, and depressions that will affect smooth, finished surfaces of markerboards and tackboards, including dirt, mold, and mildew.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, and substances that will impair bond between markerboards and tackboards and wall surfaces.

3.3 INSTALLATION, GENERAL

A. General: Install markerboards and tackboards, in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
   1. For additional rigidity, markerboards and tackboards shall be spot cemented to walls with drywall adhesive 12-inches o.c. in each direction.

3.4 INSTALLATION OF FACTORY-FABRICATED MARKERBOARDS AND TACKBOARDS

A. General: Mount markerboards, and tackboards in accordance with manufacturer's recommendations.

B. Markerboards and Tackboards: Attach boards to wall surfaces with egg-size adhesive gobs at 16 inches o.c. horizontally and vertically or closer if recommended by manufacturer.

3.5 CLEANING AND PROTECTION

A. Clean markerboards and tackboards according to manufacturer's written instructions.

B. Touch up factory-applied finishes to restore damaged or soiled areas. Remove and replace markerboards and tackboards that are damaged or do not comply with requirements. Markerboards and tackboards may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing as determined by Architect.

C. Cover and protect markerboards and tackboards after installation and cleaning.

END OF SECTION 101100

SECTION 102800 - TOILET ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Toilet accessories.
   2. Installation of Owner furnished toilet accessories.

B. Related Sections include the following:
   1. Division 06 Section "Rough Carpentry" for concealed wood blocking to support accessories.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.

C. Shop Drawings: Include blocking locations and mounting heights identified.

D. Setting Drawings: For cutouts required in other work; include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.

E. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use room and accessory designations indicated in the Toilet and Bath Accessory Schedule in Part 3 and room and accessory designations indicated on Drawings.

F. Warranties: Special warranties specified in this Section.

1.4 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.

1.5 WARRANTY

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

B. Manufacturer's Mirror Warranty: Written warranty, executed by mirror manufacturer agreeing to replace mirrors that develop visible silver spoilage defects within minimum warranty period indicated.
   1. Minimum Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch minimum nominal thickness, unless otherwise indicated.

B. Sheet Steel: ASTM A 366/A 366M, cold rolled, commercial quality, 0.0359-inch minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.

C. Galvanized Steel Sheet: ASTM A 653/A 653M, G60.

D. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.

E. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.

F. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

G. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

2.2 TOILET ACCESSORIES

A. Owner Furnished items: Contractor shall install the following items:
   1. Wall-mounted soap dispensers, SD.
   2. Paper towel dispensers, PTD.
   3. Toilet tissue dispensers, TTD.
   4. Sanitary napkin disposal unit, SND.

B. Grab Bars: Provide stainless-steel grab bar, concealed mounting with manufacturer's standard flanges and anchors, minimum nominal thickness 0.05 inch, 1-1/2 inches outside diameter for heavy-duty applications, in lengths and configurations indicated.
   1. Product: Bobrick Washroom Equipment, Inc.; B-6806 Series.

C. Channel-Framed Mirror: Fabricate frame from stainless-steel channels in manufacturer's standard polished finish with square corners mitered to hairline joints and mechanically interlocked; size as indicated on Drawings. Mirrors shall be first quality plate-glass conforming to U.S. Commercial Standard CS-27-36 with 2 coats of silver and copper clad. Mirror backs shall be zinc-coated steel.
   1. Size: As indicated.
   2. Product: Bobrick Washroom Equipment, Inc.; Model B-165 Series.

2.3 FABRICATION

A. General: One, maximum 1-1/2-inch- diameter, unobtrusive stamped manufacturer logo, as approved by Architect, is permitted on exposed face of accessories. On interior surface not exposed to view or back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.

B. Sections and shapes shall be rolled, formed, drawn, or extruded as required for respective functions.

C. Fastenings, exposed metal fastenings, and accessories, unless Underwriters prohibit for safety, shall be of same materials, texture, color and finish as the base metal to which applied.

D. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.

E. Framed Glass-Mirror Units: Fabricate frames for glass-mirror units to accommodate glass edge protection material. Provide mirror backing and support system that permits rigid, tamper-resistant glass installation and prevents moisture accumulation.
   1. Provide galvanized steel backing sheet, not less than 0.034 inch and full mirror size, with nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.

C. Grab bars shall be screwed to solid wood blocking in stud partitions. Install grab bars to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

D. Concealed Blocking: Provide concealed wood blocking, 3/4-inch thick plywood covering 32 inch by 32-inch area, in stud walls.

E. Install Owner furnished items in accordance with manufacturer's instruction and as located on Drawings.

3.2 TOILET ACCESSORIES SCHEDULE

A. Toilet Accessories in Single Person Toilet Rooms:
   1. Provide channel-framed mirror over lavatory.
   2. Install one soap dispenser (SD).
   3. Install one paper towel dispenser (PTD).
   4. Install one toilet tissue dispenser (TTD).
   5. Install one sanitary napkin disposal unit (SND).

6. Provide grab bars in configurations shown as indicated.

B. Toilet Accessories in Multi-Person Toilet Rooms:
1. Provide channel-framed mirror over each lavatory.
2. Install soap dispensers (SD) at each lavatory where indicated.
3. Install one toilet tissue dispenser (TTD) for each water closet.
4. Install paper towel dispensers (PTD) where indicated.
5. Provide grab bars in configurations shown at designated water closets. Grab bars mounted on steel framed walls shall be screwed to solid wood blocking in stud partitions.
6. Provide one sanitary napkin disposal unit (SND) for each water closet in Girls 004.

3.3 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 104400 - FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Portable fire extinguishers.
   2. Fire-protection cabinets for portable fire extinguishers.
   3. Mounting brackets for fire extinguishers.
   4. Wall signage for extinguishers.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguishers and fire-protection cabinets.
   1. Fire Extinguishers: Include rating and classification.
   2. Fire-Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

C. Samples for Initial Selection: For fire-protection cabinets with factory-applied color finishes.

D. Product Schedule: For fire protection cabinets. Coordinate final fire protection cabinet schedule with fire extinguisher schedule to ensure proper fit and function.

E. Maintenance Data: For fire extinguishers and fire-protection cabinets to include in maintenance manuals.

F. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and fire-protection cabinets through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
   1. Provide fire extinguishers approved, listed, and labeled by FMG.

D. Fire Extinguisher Inspection: Prior to installation, professionally inspect all fire extinguishers in accordance with NFPA 10, "Portable Fire Extinguishers" and attach tag to the fire extinguisher verifying inspection and inspection date. Tag shall comply with the requirements of the local authority having jurisdiction. Tag with manufacturing date only is not acceptable.

1.5 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire protection cabinets with wall depths.

1.6 WARRANTY

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

B. Special Warranty for Fire Extinguishers: Manufacturer's standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure of hydrostatic test according to NFPA 10.
      b. Faulty operation of valves or release levers.
   2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
   1. JL Industries, Inc.
   2. Larsen's Manufacturing Company.
   3. Potter Roemer; Div. of Smith Industries, Inc.

B. Fire extinguisher cabinets, fire extinguishers, and mounting brackets shall be from same manufacturer.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Stainless-Steel Sheet: ASTM A 666, Type 304.

C. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.3 PORTABLE FIRE EXTINGUISHERS

A. General: Provide fire extinguishers of type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
   1. Handles and Levers: Manufacturer's standard.
   2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:80-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.4 FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

B. Cabinet Construction: Nonrated.

C. Cabinet Material: Enameled-steel sheet.

D. Semirecessed Cabinet: Cabinet box partially recessed in walls of shallow depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
   1. Rolled-Edge Trim: 2-1/2-inch backbend depth.

E. Cabinet Trim Material: Same material and finish as door.

F. Door Material: Steel sheet.

G. Door Style: Vertical duo panel with frame.

H. Door Glazing: Tempered float glass (clear).

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
   1. Provide projecting lever handle with cam-action latch.
   2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

J. Accessories:
   1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
   2. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
   3. Identification: Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER"; lettering complying with authorities having jurisdiction for letter style, size, spacing, and location; lettering orientation and color as selected by Architect. Locate as indicated by Architect.

K. Finishes:
   1. Manufacturer's standard baked-enamel or powder coat for the following:

a. Exterior of cabinet, door, and trim, except for those surfaces indicated to receive another finish.
b. Interior of cabinet and door.
c. Color and Texture: As selected by Architect from manufacturer's full range.

2.5 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
1. Color: Black.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
a. Orientation: Vertical.
2. Location: Provide for bracket mounted extinguishers in all mechanical rooms and where indicated.

2.6 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
1. Weld joints and grind smooth. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 STEEL FINISHES

A. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond using manufacturer's standard methods.

B. Baked-Enamel Finish or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

2.9 WALL SIGNAGE FOR EXTINGUISHERS

A. Wall Signage for Extinguishers: Provide 3-dimensional, projecting, photoluminescent signage for wall mounting; sign shall have a graphic of a fire extinguisher and an arrow pointing to fire extinguisher on each face of sign; and shall be roughly 6 inches high and project from wall approximately 5 inches. Provide with mounting hardware. Wall signage is in addition to the identification signage specified on the fire extinguisher in Articles 2.4.J.3 and 2.5.B above.
   1. Locations: Provide at each fire extinguisher cabinet and at each bracket mounted fire extinguisher.
   2. Product: Fire Extinguisher Signs, Model S-4663; website: www.fireextinuishersings.com.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

B. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged units.

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

3.2 PREPARATION

A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection specialties in locations and at mounting heights indicated or, if not indicated, at heights indicated below:
   1. Fire-Protection Cabinets: 54 inches above finished floor to top of cabinet.
   2. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.

B. Fire-Protection Cabinets: Fasten fire-protection cabinets to structure, square and plumb.
   1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire-protection cabinets.
   2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

D. Identification: Apply decals at locations indicated.

E. Wall Signage: Mount where indicated in accordance with manufacturer's instructions.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection specialties are installed, unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet manufacturer.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104400

SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Piping materials and installation instructions common to most piping systems.
   2. Transition fittings.
   3. Dielectric fittings.
   4. Mechanical sleeve seals.
   5. Sleeves.
   6. Escutcheons.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:
   1. ABS: Acrylonitrile-butadiene-styrene plastic.
   2. CPVC: Chlorinated polyvinyl chloride plastic.
   3. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:
   1. EPDM: Ethylene-propylene-diene terpolymer rubber.
   2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Transition fittings.
   2. Mechanical sleeve seals.
   3. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
   1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

2.4 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
1. Manufacturers:
   a. Cascade Waterworks Mfg. Co.
   b. Dresser Industries, Inc.; DMD Div.
   c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
   d. JCM Industries.
   e. Smith-Blair, Inc.
   f. Viking Johnson.
2. Underground Piping NPS 2 (DN 50) and Larger: AWWA C219, metal sleeve-type coupling.
3. Aboveground Pressure Piping: Pipe fitting.
4. Manufacturers:
   a. Eslon Thermoplastics.

B. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
1. Manufacturers:
   a. Thompson Plastics, Inc.

C. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
1. Manufacturers:
   a. NIBCO INC.
   b. NIBCO, Inc.; Chemtrol Div.

D. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

1. Manufacturers:
    a. Cascade Waterworks Mfg. Co.
    b. Fernco, Inc.
    c. Mission Rubber Company.
    d. Plastic Oddities, Inc.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
1. Manufacturers:
    a. Capitol Manufacturing Co.
    b. Central Plastics Company.
    c. Eclipse, Inc.
    d. Epco Sales, Inc.
    e. Hart Industries, International, Inc.
    f. Watts Industries, Inc.; Water Products Div.
    g. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

1. Available Manufacturers:
    a. Calpico, Inc.
    b. Lochinvar Corp.

E. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
1. Available Manufacturers:
    a. Perfection Corp.
    b. Precision Plumbing Products, Inc.
    c. Sioux Chief Manufacturing Co., Inc.
    d. Victaulic Co. of America.

2.6 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. PVC Pipe: ASTM D 1785, Schedule 40.

2.7 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to within 18” of the ceiling to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
   1. New Piping:
      a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
      b. Insulated Piping: One-piece, stamped-steel type with spring clips.
      c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.

d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.

M. Sleeves are not required for core-drilled holes.

N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
1. Cut sleeves to length for mounting flush with both surfaces.
a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
1) Seal space outside of sleeve fittings with grout.
4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

O. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Joint Sealants" for materials.

Q. Verify final equipment locations for roughing-in.

R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   2. PVC Nonpressure Piping: Join according to ASTM D 2855.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
   1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.

END OF SECTION 220500

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SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Thermometers.
2. Gages.
3. Test plugs.

B. Related Sections:
1. Division 22 for domestic and fire-protection water service meters outside the building.
2. Division 22 Section "Domestic Water Piping" for domestic and fire-protection water service meters inside the building.
3. Division 22 for gas meters.

1.3 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated; include performance curves.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED DIAL THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide Trerice H.O. Co. or comparable product by one of the following:
1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
2. Palmer - Wahl Instruments Inc.
3. Trerice, H. O. Co.
4. Weiss Instruments, Inc.
5. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.

C. Description: Direct-mounting, bimetallic-actuated dial thermometers complying with ASME B40.3.

D. Case: Dry type, stainless steel with 5-inch (127-mm) diameter.

E. Element: Bimetal coil.

F. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.

G. Pointer: Red or other dark-color metal.

H. Window: Glass.

I. Ring: Metal, Brass or Stainless steel.

J. Connector: Adjustable angle type.

K. Stem: Metal, for thermowell installation and of length to suit installation.

L. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.2 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide Trerice H.O. Co. product indicated on Drawings or comparable product by one of the following:
1. AMETEK, Inc.; U.S. Gauge Div.
2. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
3. Palmer - Wahl Instruments Inc.
4. Trerice, H. O. Co.
5. Weiss Instruments, Inc.
6. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.

C. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.
1. Case: Dry type, drawn steel or cast aluminum , 4-1/2-inch (114-mm) diameter.
2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
3. Pressure Connection: Brass, NPS 1/4 (DN 8), bottom-outlet type unless back-outlet type is indicated.
4. Movement: Mechanical, with link to pressure element and connection to pointer.
5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
6. Pointer: Red or other dark-color metal.
7. Window: Glass or plastic.
8. Ring: Metal, Brass or Stainless steel.
9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure (100 kPa of vacuum to 103 kPa of pressure).
11. Range for Fluids under Pressure: Two times operating pressure.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

A. Install direct-mounting, vapor-actuated dial thermometers in the outlet of each domestic, hot-water storage tank.

B. Install dry -case-type, vapor -actuated dial thermometers at suction and discharge of each pump.

C. Provide the following temperature ranges for thermometers:
   1. Domestic Hot Water: 30 to 180 deg F, with 2-degree scale divisions (Minus 1 to plus 82 deg C, with 1-degree scale divisions).
   2. Domestic Cold Water: 0 to 100 deg F, with 2-degree scale divisions (Minus 18 to plus 38 deg C, with 1-degree scale divisions).

3.2 GAGE APPLICATIONS

A. Install dry-case-type pressure gages for discharge of each pressure-reducing valve.

B. Install dry-case-type pressure gages at suction and discharge of each pump.

C. Pressure scale: 0 to 100 psi at 2 psi scale divisions.

3.3 INSTALLATIONS

A. Install direct-mounting thermometers and adjust vertical and tilted positions.

B. Install remote-mounting dial thermometers on panel, with tubing connecting panel and thermometer bulb supported to prevent kinks. Use minimum tubing length.

C. Install thermowells with socket extending one-third of diameter of pipe and in vertical position in piping tees where thermometers are indicated.

D. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.

E. Install remote-mounting pressure gages on panel.

F. Install needle-valve and snubber fitting in piping for each pressure gage.

G. Install test plugs in tees in piping.

H. Install permanent indicators on walls or brackets in accessible and readable positions.

I. Install connection fittings for attachment to portable indicators in accessible locations.

J. Install thermometers and gages adjacent to machines and equipment to allow service and maintenance for thermometers, gages, machines, and equipment.

K. Adjust faces of thermometers and gages to proper angle for best visibility from the floor.

END OF SECTION 220519

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Bronze ball valves.
   2. Bronze swing check valves.
   3. Fast Fill Quick Connect Valve.
   4. Boiler Drain Tempering Valve.

B. Related Sections:
   1. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. SWP: Steam working pressure.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:
   1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
   2. ASME B31.1 for power piping valves.
   3. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, grooves, and weld ends.
   3. Set ball and plug valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:
   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:
   1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

E. Valve-End Connections:
   1. Solder Joint: With sockets according to ASME B16.18.
   2. Threaded: With threads according to ASME B1.20.1.

F. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRASS BALL VALVES

A. Two-Piece, Full-Port, Brass Ball Valves:
   1. Manufacturers: Subject to compliance with requirements:
      a. Conbraco Industries, Inc.; Apollo Valves.
      b. Milwaukee Valve Company.
      c. NIBCO INC.
      d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   2. Description:
      a. Standard: MSS SP-110.
      b. SWP Rating: 150 psig (1035 kPa).
      c. CWP Rating: 600 psig (4140 kPa).
      d. Body Design: Two piece.
      e. Body Material: Bronze.
      f. Ends: Threaded.
      g. Seats: PTFE or TFE.

h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

2.3 BRONZE SWING CHECK VALVES

A. Class 150, Bronze Swing Check Valves with Bronze Disc:
1. Manufacturers: Subject to compliance with requirements:
a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Zy-Tech Global Industries, Inc.
2. Description:
a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 300 psig (2070 kPa).
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

2.4 FAST FILL QUICK CONNECT VALVES

A. Fast fill water fill connection for the boilers.
1. Manufacturers: Subject to compliance with requirements:
a. GoodYear Engineered Products
2. Description:
a. "INSTA-LOCK" Couplings. Provide three fittings at each location. Provide one "Type A" fitting, model A200AL, one "Type D" fitting, model D200AL and one type "DUST CAP", model DC200AL.
b. Pressure Rating: 250 psig.
c. Body Design: Horizontal flow.
d. Body Material: Aluminum.
e. Ends: Threaded with quick connect coupling.

2.5 BOILER DRAIN TEMPERING VALVE

A. Fast fill water fill connection for the boilers.
1. Manufacturers: Subject to compliance with requirements:
a. Robertshaw/Invensys, Honeywell, Hoffman.
2. Basis of design:
a. Robertshaw model RT1001-S3112, Reverse acting, "FA" body style, bronze body, brass trim, union ends, 1" size, ¾" x 10" long bulb with 10 foot capillary length, and a temp range of 85°f to 145°f. Temperature shall be set to maximum of 140°f discharge to the sanitary system.
3.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:
   1. Swing Check Valves: In horizontal position with hinge pin level.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:
   1. Shutoff Service: ball valves.
   2. Throttling Service: ball valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:
   1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:
   1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
   2. Ball Valves: Two piece, full port, brass with chrome plated brass trim.
   3. Bronze Swing Check Valves: Class 150, bronze disc.

END OF SECTION 220523

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SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following hangers and supports for plumbing system piping and equipment:
   1. Steel pipe hangers and supports.

B. Trapeze pipe hangers.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Steel pipe hangers and supports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Available Manufacturers:
   1. B-Line Systems, Inc.; a division of Cooper Industries.
   2. Carpenter & Paterson, Inc.
   3. ERICO/Michigan Hanger Co.
   4. Grinnell Corp.

C. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
   2. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.

G. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).

H. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).
   2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
   2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
   3. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
   4. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

K. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

L. Fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
   2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.

F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

H. Insulated Piping: Comply with the following:
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
   2. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
      a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3. Shield Dimensions for Pipe: Not less than the following:
   a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
4. Insert Material: Length at least as long as protective shield.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

END OF SECTION 220529

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Pipe labels.
   2. Valve tags.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Pre-coiled, semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
   1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
   2. Lettering Size: At least 1-1/2 inches (38 mm) high.

2.2 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.
   1. Tag Material: Brass, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
   2. Fasteners: Brass wire-link or beaded chain; or S-hook .

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
   1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
   3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
   4. At access doors, manholes, and similar access points that permit view of concealed piping.
   5. Near major equipment items and other points of origination and termination.
   6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.

B. Pipe Label Color Schedule:
   1. Domestic Cold Water Piping:
      a. Background Color: Green.
      b. Letter Color: White.
   2. Domestic Hot Water, and Hot Water Return Piping:
      a. Background Color: Yellow.
      b. Letter Color: Black.
   3. Storm Drainage Piping:
      a. Background Color: Green.
      b. Letter Color: White.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
   1. Valve-Tag Size and Shape:
      a. Cold Water: 1-1/2 inches (38 mm), round.
      b. Hot Water: 1-1/2 inches (38 mm), round.
      c. Compressed Air: 1-1/2 inches (38 mm), round.
   2. Valve-Tag Color:
      a. Cold Water: Natural.
      b. Hot Water: Natural.

END OF SECTION 220553

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SECTION 220700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Insulation Materials:
      a. Fiberglass.
   2. Field-applied jackets.
   3. Tapes.
   4. Securements.
   5. Corner angles.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Qualification Data: For qualified Installer.

C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Fibergl, Preformed Pipe Insulation:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Johns Manville; Micro-Lok.
      b. Knauf Insulation; 1000(Pipe Insulation.
      c. Owens Corning; Fiberglas Pipe Insulation.
   2. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Fiberglass Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Childers Products, Division of ITW; CP-82.
      b. Foster Products Corporation, H. B. Fuller Company; 85-20.
      c. ITW TACC, Division of Illinois Tool Works; S-90/80.
      d. Marathon Industries, Inc.; 225.
      e. Mon-Eco Industries, Inc.; 22-25.
   2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Childers Products, Division of ITW; CP-82.
      b. Foster Products Corporation, H. B. Fuller Company; 85-20.
      c. ITW TACC, Division of Illinois Tool Works; S-90/80.
      d. Marathon Industries, Inc.; 225.
      e. Mon-Eco Industries, Inc.; 22-25.
   2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 FIELD-APPLIED JACKETS

A. Aluminum Jacket: ASTM B209, ASTM B209M.
   1. Thickness: 0.016 inch sheet.
   2. Finish: Corrugated.
   3. Joining: Longitudinal slip joints and 2 inch laps.
   4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

2.4 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
      b. Compac Corp.; 104 and 105.
      c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
      d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
   2. Width: 3 inches (75 mm).
   3. Thickness: 11.5 mils (0.29 mm).
   4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
   5. Elongation: 2 percent.
   6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
   7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
   1. Verify that systems and equipment to be insulated have been tested and are free of defects.
   2. Verify that surfaces to be insulated are clean and dry.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.
   a. For below ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:
1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

Q. Pipe Exposed in Mechanical Equipment Rooms 10 feet or Less Above Finished Floor:
1. Piping Which Crosses Walking and Service Access Paths 4 feet or Less Above Finished Floor: Finish with aluminum jacket and fitting covers.
2. Other Piping: Finish with aluminum jacket and fitting covers.

3.4 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
   1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
   2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
   3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
   4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
   5. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
   6. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
   7. Label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
   1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
   2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
   3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 FIBERGLASS INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

C. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
1. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
2. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent

of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

3.9 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:
   1. NPS ½ and NPS ¾ : Insulation shall be one of the following:
      a. Fiberglass, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.
   2. NPS 1 (DN 25) and NPS 1-1/4 (DN 32): Insulation shall be one of the following:
      a. Fiberglass, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.
   3. NPS 1-1/2 (DN 40) and Larger: Insulation shall be one of the following:
      a. Fiberglass, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

B. Domestic Hot Water:
   1. NPS 1 (DN 25) and Smaller: Insulation shall be one of the following:
      a. Fiberglass, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
   2. NPS 1-1/4 (DN 32) : Insulation shall be the following:
      a. Fiberglass, Preformed Pipe Insulation, Type I: 1-1/2 inch (38 mm) thick.
   3. NPS 1-1/2 (DN 40) and NPS 2 (DN 50) : Insulation shall be the following:
      a. Fiberglass, Preformed Pipe Insulation, Type I: 1-1/2 inch (38 mm) thick.
   4. NPS 2-1/2 (DN 63): Insulation shall be the following:
      a. Fiberglass, Preformed Pipe Insulation, Type I: 2 inch (50 mm) thick.

END OF SECTION 220700

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Boiler Feed Water Meter.
   2. Escutcheons.
   3. Sleeves and sleeve seals.

1.3 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61 for potable domestic water piping and components.

1.4 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
   1. Notify Owner no fewer than two days in advance of proposed interruption of water service.
   2. Do not proceed with interruption of water service Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) water tube, drawn temper.
   1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
   2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
   3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Elkhart Products Corporation; Industrial Division.
         2) NIBCO INC.

2.3 PIPING JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

2.4 TRANSITION FITTINGS

A. General Requirements:
   1. Same size as pipes to be joined.
   2. Pressure rating at least equal to pipes to be joined.
   3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.

   1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

      a. Cascade Waterworks Manufacturing.
      b. Dresser, Inc.; Dresser Piping Specialties.
      c. Ford Meter Box Company, Inc. (The).
      d. JCM Industries.
      e. Romac Industries, Inc.
      f. Smith-Blair, Inc; a Sensus company.
      g. Viking Johnson; c/o Mueller Co.

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Capitol Manufacturing Company.
      b. Central Plastics Company.
      c. EPCO Sales, Inc.
      d. Hart Industries International, Inc.
      e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
      f. Zurn Plumbing Products Group; Wilkins Water Control Products.

   2. Description:

      a. Pressure Rating: 150 psig (1035 kPa) at 180 deg F (82 deg C).

b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Calpico, Inc.
b. Lochinvar Corporation.

2. Description:

a. Galvanized-steel coupling.
b. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
c. End Connections: Female threaded.
d. Lining: Inert and noncorrosive, thermoplastic.

D. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following:

a. Perfection Corporation; a subsidiary of American Meter Company.
b. Precision Plumbing Products, Inc.
c. Victaulic Company.

2. Description:

a. Electroplated steel nipple complying with ASTM F 1545.
b. Pressure Rating: 300 psig (2070 kPa) at 225 deg F.
c. End Connections: Male threaded or grooved.
d. Lining: Inert and noncorrosive, propylene.

2.6 WATER METER

A. Displacement-Type Water Meters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

2. Basis of Design: DLJ METER model DLJ 150, 1-1/2" multijet impeller meter.

a. Standard: AWWA C708.
b. Pressure Rating: 150-psig (1035-kPa) working pressure.
c. Body Design: Inferential impeller.
d. Registration: In gallons.
e. Case: Epoxy coated bronze body..
f. End Connections: Threaded.

B. Remote Registration System: Direct-reading type complying with AWWA C708; modified with signal transmitting assembly, low-voltage connecting wiring, and remote register assembly. Connect to the building management system.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance.

C. Install domestic water piping level and plumb.

D. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

G. Install piping adjacent to equipment and specialties to allow service and maintenance.

H. Install piping to permit valve servicing.

I. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

J. Install piping free of sags and bends.

K. Install fittings for changes in direction and branch connections.

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

3.3 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

B. Install shut-off valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping NPS 2 (DN 50) and smaller.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
   1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
   2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

   1. NPS 1-1/2 (DN 40) and Smaller: Fitting-type coupling.
   2. NPS 2 (DN 50) and Larger: Sleeve-type coupling.

3.5 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric couplings.

3.6 WATER METER INSTALLATION

A. Rough-in domestic water piping for water meter installation according to utility company's requirements.

B. The Primary water meter will be furnished by and installed utility company.

C. The Secondary meter will be furnished and installed by the contractor.

D. Install water meters according to AWWA M6, utility company's requirements, and the following:

E. Install displacement-type water meters with shutoff valve on water-meter inlet. Install valve on water-meter outlet and valved bypass around meter unless prohibited by authorities having jurisdiction.

F. Install turbine-type water meters with shutoff valve on water-meter inlet. Install valve on water-meter outlet and valved bypass around meter unless prohibited by authorities having jurisdiction.

G. Install compound-type water meters with shutoff valves on water-meter inlet and outlet and on valved bypass around meter. Support meters, valves, and piping on brick or concrete piers.

H. Install fire-service water meters with shutoff valves on water-meter inlet and outlet and on full-size valved bypass around meter. Support meter, valves, and piping on brick or concrete piers.

I. Install remote registration system according to standards of utility company and of authorities having jurisdiction.

3.7 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.

3.8 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to existing water piping within the building.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
   1. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.

3.9 ESCUTCHEON INSTALLATION

A. Install escutcheons for penetrations of walls, ceilings, and floors.

B. Escutcheons for New Piping:
   1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
   2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish .
   3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish .

C. Escutcheons for Existing Piping:
   1. Chrome-Plated Piping: Split casting, cast brass with chrome-plated finish.
   2. Insulated Piping: Split plate, stamped steel with concealed hinge and spring clips.

3.10 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

B. Label pressure piping with system operating pressure.

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:
   1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
   2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
      a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
      b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
   3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
   4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:
   1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
   2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
   3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   4. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
   5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
   6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.12 ADJUSTING

A. Perform the following adjustments before operation:
   1. Close drain valves, hydrants, and hose bibbs.

2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
    b. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.13 CLEANING

A. Clean and disinfect potable domestic water piping as follows:
    1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
    2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
        a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
        b. Fill and isolate system according to either of the following:
            1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
            2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.
        c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
        d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.14 PIPING SCHEDULE

A. Aboveground domestic water piping, NPS 2 (DN 50) and smaller, shall be one of the following:
    1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); cast- copper solder-joint fittings; and soldered joints.
    2. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B) ; copper push-on-joint fittings; and push-on joints.

3.15 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
    1. Shutoff Duty: Use ball valves for piping NPS 2 (DN 50) and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.

2. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 221116

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SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following domestic water piping specialties:
1. Vacuum breakers.
2. Backflow preventers.
3. Water Entrance Pressure-Reducing Valve.
4. Temperature-actuated water mixing valves.
5. Strainers.
6. Hose bibbs.
7. Wall hydrants.
8. Drain valves.
9. Water hammer arresters.

B. Related Sections include the following:
1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Division 22 Section "Domestic Water Piping" for water meters.
3. Division 22 Section "Emergency Plumbing Fixtures".

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig (860 kPa), unless otherwise indicated.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

C. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 01 through 09."

PART 2 - PRODUCTS

2.1 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. FEBCO; SPX Valves & Controls.
   b. Watts Industries, Inc.; Water Products Div.
   c. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1012.
3. Operation: Continuous-pressure applications.
4. Size: NPS 3/4 (DN 20).
5. Body: Bronze.
6. End Connections: Solder joint.
7. Finish: Rough bronze.

B. Reduced-Pressure-Principle Backflow Preventers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Watts. Subject to compliance with requirements, provide a comparable product by one of the following:
   a. Ames Co.
   b. FEBCO; SPX Valves & Controls.
   c. Watts Industries, Inc.; Water Products Div.
   d. Zurn Plumbing Products Group; Wilkins Div.
3. Water Entrance: Model 2-909M1-QT-S, 2” Threaded with 2” quarter turn ball valves. The Reduced Pressure Zone Assembly shall consist of two independent torsion spring check modules, a differential pressure relief valve located between and below the two modules, two drip tight shutoff valves, and required torsion spring check modules and relief valve shall be contained with a sleeve accessible single housing constructed from 304 (Schedule 40) stainless steel pipe with groove end connections. Torsion spring checks shall have replaceable elastomeric discs and in operation produce drip tight closure against the reverse flow of liquid caused by backpressure or backsiphonage.
4. Boiler Make-up: Model 1-1/2-909M1-QT-S, 1-1/2” Threaded with 1-1/2” quarter turn ball valves. The Reduced Pressure Zone Assembly shall consist of two independent torsion spring check modules, a differential pressure relief valve located between and below the two modules, two drip tight shutoff valves, and required torsion spring check modules and relief valve shall be contained with a sleeve accessible single housing constructed from 304 (Schedule 40) stainless steel pipe with groove end connections. Torsion spring checks shall have replaceable elastomeric discs and in operation produce drip tight closure against the reverse flow of liquid caused by backpressure or backsiphonage.
5. Standard: ASSE 1013.
6. Operation: Continuous-pressure applications.

7. Configuration: Designed for horizontal, straight through flow.
8. Provide Series 909-AG-F Air Gap fitting.

2.1 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Watts Industries, Inc.; Water Products Div.
   b. Zurn Plumbing Products Group; Wilkins Div.
2. Basis of Design: Watts model LFU5B-Z3-G, 2" size with threaded inlet and outlet, strainer and optional pressure gauge, adjustable pressure range of 25 psi to 75 psi.
3. Standard: ASSE 1003.
4. Pressure Rating: Initial working pressure of 300 psig.
5. Size: 2".
6. Design Flow Rate: 85 gpm.
7. Pressure Drop at design flow rate: 15 psig.
8. Design Outlet Pressure Setting: 75 psig.
9. Body: Lead Free cast copper alloy.
10. End Connections: Threaded.
11. Gauge: Provide optional gauge.

2.2 HOSE BIBBS

A. Hose Bibbs:
1. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following: Chicago Faucet model 293-E27CP.
2. Standard: ASME A112.18.1 for sediment faucets.
3. Body Material: Polished Chrome.
4. Seat: Slow Compression, replaceable.
5. Supply Connections: NPS 1/2 threaded or solder-joint inlet.
6. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
7. Pressure Rating: 125 psig (860 kPa).
8. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
9. Finish for Equipment Rooms: Chrome plated.
10. Finish for Service Areas: Chrome plated.
11. Finish for Finished Rooms: Chrome plated.
12. Operation for Equipment Rooms: Operating key.
13. Operation for Service Areas: Operating key.
14. Operation for Finished Rooms: Operating key.
15. Include operating key with each operating-key hose bibb.
16. Include wall flange with each chrome-plated hose bibb.

2.3 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:
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:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Woodford Manufacturing Company.
   g. Zurn Plumbing Products Group; Specification Drainage Operation.
3. Standard: ASME A112.21.3M for concealed -outlet, self-draining wall hydrants.
4. Pressure Rating: 125 psig (860 kPa).
5. Operation: Loose key.
6. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
7. Inlet: NPS 3/4.
8. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
9. Box: Deep, flush mounting with cover.
10. Box and Cover Finish: Polished nickel bronze .
11. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
12. Nozzle and Wall-Plate Finish: Polished nickel bronze.
13. Operating Keys(s): One with each wall hydrant.

2.4 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:
   1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
   2. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
   3. Size: NPS 3/4 (DN 20).
   4. Body: Copper alloy.
   5. Ball: Chrome-plated brass.
   6. Seats and Seals: Replaceable.
   7. Handle: Vinyl-covered steel.
   8. Inlet: Threaded or solder joint.
   9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.5 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:
   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:
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. PPP Inc.
      b. Sioux Chief Manufacturing Company, Inc.
      c. Watts Drainage Products Inc.
      d. Zurn Plumbing Products Group; Specification Drainage Operation.
   3. Standard: ASSE 1010 or PDI-WH 201.

4. Type: Copper tube with piston.
5. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.6 THERMOSTATIC WATER MIXING VALVES

A. Thermostatic, Water-Mixing-Valve Assembly :
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Powers.
      b. Watts.
      c. Leonard.
   2. Basis-of-Design Product: Subject to compliance with requirements, provide Powers, model LFLM491-1, Lead Free, Hi-Low Thermostatic Mixing Valve.
   3. Description: Factory-fabricated, exposed-mounting, thermostatically controlled, water-mixing-valve assembly in a single valve arrangement.
   4. Thermostatic Mixing Valves: Comply with ASSE 1017. Include check stops on hot- and cold-water inlets and shutoff valve on outlet.
   5. Water Regulator(s): Comply with ASSE 1003. Include pressure gage on inlet and outlet.
   6. Component Pressure Ratings: 125 psig (860 kPa) minimum, unless otherwise indicated.
   7. Valve Size: 3/4 inlets with 3/4" outlet.
   8. Tempered-Water Setting: 120 deg F (deg C).
   9. Unit Tempered-Water Design Flow Rate: 7.6 gpm.
   10. Unit Minimum Tempered-Water Design Flow Rate: 0.5gpm (L/s) (Must be ASSE 1017 Rated flow).
   11. Unit Pressure Drop at Design Flow Rate: 5 psig (kPa).
   12. Thermostatic Mixing Valve and Water Regulator Finish: Rough bronze.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
   1. Locate backflow preventers in same room as connected equipment or system.
   2. Backflow preventers shall be accessible from a standing position on the floor.
   3. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
   4. Do not install bypass piping around backflow preventers.

C. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

D. Install water control valves with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

E. Install balancing valves in locations where they can easily be adjusted.

F. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
   1. Install thermometers and water regulators if specified.
   2. Install cabinet-type units recessed in or surface mounted on wall as specified.

G. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve.

H. Install outlet boxes recessed in wall. Install 2-by-4-inch (38-by-89-mm) fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."

I. Install water hammer arresters in water piping according to PDI-WH 201.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according to Division 26 Section "Grounding and Bonding."

C. Connect wiring according to Division 26.

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
   1. Primary, thermostatic, water mixing valves.
   2. Primary water tempering valves.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:
   1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.5 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 221119

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ECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - ENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following for soil, waste, and vent piping inside the building including vents through the roof:

1.3 DEFINITIONS

A. BS: Acrylonitrile-butadiene-styrene plastic.

B. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

B. oil, Waste, and Vent Piping: 10-foot head of water 30 kPa or 5 psi.

1.5 SUBMITTALS

A. roduct Data: For pipe, tube, fittings, and couplings.

B. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron drainage fittings.

C. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

1. Heavy Duty, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
   a. Manufacturers:
      1) ANACO.
      2) Fernco, Inc.
      3) Ideal Div.; Stant Corp.
      4) Mission Rubber Co.
      5) Tyler Pipe; Soil Pipe Div.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to section 03300 for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Aboveground, soil, waste and vent piping shall be the following:
   1. Hubless cast-iron soil pipe and fittings heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
   2. Copper DWV tube, copper drainage fittings, and soldered joints.

B. Underground, soil, waste, and vent piping shall be the following:
   1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.

3.3 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

C. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.

D. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used

on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

E. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

F. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
   1. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
   2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

G. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

3.5 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
   1. Vertical Piping: MSS Type 8 or Type 42, clamps.
   2. Install individual, straight, horizontal piping runs according to the following:

B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

E. Maximum spans below were taken from MSS SP-69 for water service and from model plumbing codes. Most restrictive piping and spacing dimensions are shown.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
   2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.

3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.

G. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

I. NPS 1-1/4 (DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.

J. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.

K. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect drainage and vent piping to the following:
1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with

water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.8 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221316

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SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:
   1. Cleanouts.
   2. Floor drains.
   3. Trench Drain Grates

B. Related Sections include the following:
   1. Division 22 Section "Plumbing Fixtures".

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Metal Floor Cleanouts FCO:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product by Watts model CO200-RX heavy duty rating or one of the following:
      a. Josam Company; Josam Div.
      b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      c. Watts Drainage Products Inc.
      d. Zurn Plumbing Products Group; Specification Drainage Operation.
   2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
   3. Size: Same as connected branch.
   4. Type: Threaded, adjustable housing.
   5. Body or Ferrule: Cast iron.
   6. Clamping Device: Not required.
   7. Outlet Connection: Inside caulk.
   8. Closure: Plastic plug.
   9. Adjustable Housing Material: Cast iron with threads.
   10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
   11. Frame and Cover Shape: 5-1/8” Round.

12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
13. Standard: ASME A112.3.1.

B. Floor Drains FD-1:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide Watts, model FD-200-L8-9-5, heavy duty rating or a comparable product by one of the following:
   a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   b. Watts Drainage Products Inc.
   c. Zurn Plumbing Products Group; Specification Drainage Operation.
3. Standard: ASME A112.6.3
4. Pattern: Floor drain.
5. Body Material: Gray iron.
6. Seepage Flange: Required.
7. Anchor Flange: Required.
8. Clamping Device: Required.
9. Outlet: Bottom.
10. Coating on Interior and Exposed Exterior Surfaces: Required.
11. Sediment Bucket: Required.
12. Top or Strainer Material: Nickel bronze.
13. Top of Body and Strainer Finish: Nickel bronze.
14. Top Shape: Square.
15. Dimensions of Top or Strainer: 8 inch square with optional "-9" hinged grate.
16. Top Loading Classification: Heavy Duty.
17. Trap Material: Cast Iron.
18. Trap Pattern: Standard P-trap.

C. Trench Drain Grating:
1. Basis-of-Design Product: Subject to compliance with requirements, provide FIBERGRATE Composite Structures, 1-1/2" deep x 1-1/2" square mesh, 12" wide in 12' long sections, heavy duty rating, reinforced fiberglass composite, yellow color, 70% open area.
2. Pattern: Square mesh.
3. Surface: Standard Meniscus Top.
4. Securing: Loose fit grates set in trench.
5. Size: Grates shall be manufactured 12" wide by 48" long. Grating may be cut in the field to fit overall trench length.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 100 feet for all piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Tests and Inspections:
1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

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SECTION 221413 - FACILITY STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following storm drainage piping inside the building:
   1. Pipe, tube, and fittings.
   2. Special pipe fittings.

1.3 DEFINITIONS

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working-pressure, unless otherwise indicated:
   1. Storm Drainage Piping: 10-foot head of water 30 kPa or 5 psi.

1.5 SUBMITTALS

A. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
   1. Heavy Duty, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve. Manufacturers:
      a. ANACO.

b. Fernco, Inc.
c. Ideal Div.; Stant Corp.
d. Mission Rubber Co.
e. Tyler Pipe; Soil Pipe Div.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground storm drainage piping NPS 6 (DN 150) and smaller shall be the following:
1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and coupled joints.

3.2 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers. Cleanouts are specified in Division 22 Section "Storm Drainage Piping Specialties."

C. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. 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.

D. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:
1. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.

E. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

3.4 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:
a. MSS Type 1, adjustable, steel clevis hangers.
3. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

E. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
5. NPS 8 to NPS 12 (DN 200 to DN 300): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.

F. Install supports for vertical PVC piping every 48 inches (1200 mm).

G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

3.6 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage 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 storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Test Procedure: Test storm drainage piping**,** except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa) 5 psi. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
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.

3.7 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 221413

SECTION 221423 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following storm drainage piping specialties inside the building:
   1. Cleanouts.
   2. Roof drains.
   3. Miscellaneous storm drainage piping specialties.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

1.5 COORDINATION

A. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 ROOF DRAINS

A. Metal Roof Drains:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   2. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn ZA100-DP-E5 or a comparable product by one of the following:
      a. Josam Company; Josam Div.
      b. MIFAB, Inc.
      c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      d. Watts Drainage Products Inc.
      e. Zurn Plumbing Products Group; Specification Drainage Operation.
   3. Standard: ASME A112.21.2M.
   4. Pattern: Roof drain with top-set deck plate.
   5. Body Material: Cast iron.
   6. Dimensions of Body: 15” with top set deck plate.
   7. Combination Flashing Ring and Gravel Stop: Not required.
   8. Outlet: Bottom

9. Dome Material: Aluminum
10. Extension Collars: 5” extension to match the insulation thickness.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
   1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
   2. Locate at each change in direction of piping greater than 45 degrees.
   3. Locate at minimum intervals of 100 feet (15 m) for all piping
   4. Locate at base of each vertical storm conductor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. Install through-penetration firestop assemblies in plastic conductors at floor penetrations.

E. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions. Roofing materials are specified in Division 07.
   1. Install roof-drain flashing collar or flange so that there will be no leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
   2. Position roof drains for easy access and maintenance.

F. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221423

SECTION 221513 - GENERAL-SERVICE COMPRESSED-AIR PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes piping and related specialties for general-service compressed-air systems operating at 200 psig (1380 kPa) or less.

B. Related Sections include the following:
   1. Division 22 Section "General-Service Packaged Air Compressors and Receivers" for general-service air compressors and accessories.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. CR: Chlorosulfonated polyethylene synthetic rubber.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. HDPE: High-density polyethylene plastic.

E. NBR: Acrylonitrile-butadiene rubber.

F. PE: Polyethylene plastic.

G. Compressed-Air Piping: System of compressed-air piping and specialties operating at pressures of 150 psig (1035 kPa) or less.

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Plastic pipes, fittings, and valves.
   2. Dielectric fittings.
   3. Flexible pipe connectors.
   4. Safety valves.
   5. Pressure regulators. Include rated capacities and operating characteristics.
   6. Automatic drain valves.
   7. Filters. Include rated capacities and operating characteristics.
   8. Lubricators. Include rated capacities and operating characteristics.
   9. Quick couplings.
   10. Hose assemblies.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For general-service compressed-air piping specialties to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Pressure-Seal Joining Procedure for Copper Tubing: Qualify operators according to training provided by Viega; Plumbing and Heating Systems.

B. ASME Compliance:
   1. Comply with ASME B31.1, "Power Piping," for high-pressure compressed-air piping.
   2. Comply with ASME B31.9, "Building Services Piping," for low-pressure compressed-air piping.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Copper Tube: ASTM B 88, Type L ASTM B 88M, Type A or B) seamless, drawn-temper, water tube with pressure seal joints and fittings.
   1. Soldered Type Fittings, NPS 2 (DN 50) and Smaller: Wrought-copper fitting with soldered fittings and joints.
   2. OPTION (must be approved by the owner): Press-Type Fittings, NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Viega; Plumbing and Heating Systems.

2.2 JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

2.3 VALVES

A. Metal Ball Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping."

2.4 FLEXIBLE PIPE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Flex-Hose Co., Inc.
   2. Flexicraft Industries.
   3. Hyspan Precision Products, Inc.
   4. Mercer Rubber Co.
   5. Metraflex, Inc.
   6. Proco Products, Inc.

7. Unaflex, Inc.
8. Universal Metal Hose; a Hyspan Company

B. Stainless-Steel-Hose Flexible Pipe Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
1. Working-Pressure Rating: 200 psig (1380 kPa)
2. End Connections, NPS 2 (DN 50) and Smaller: Threaded steel pipe nipple.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Low-Pressure Compressed-Air Distribution Piping:
1. NPS 2 (DN 50) and Smaller: Type L, copper tube; wrought-copper fittings; and soldered joints.

B. Drain Piping:
1. NPS 2 and Smaller: Type M (Type C) copper tube; wrought-copper fittings; and brazed or soldered joints.

3.2 VALVE APPLICATIONS

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for metal general-duty valves. Use metal valves, unless otherwise indicated.
1. Metal General-Duty Valves: Use valve types specified in "Valve Applications" Article in Division 22 Section "General-Duty Valves for Plumbing Piping" according to the following:
Compressed Air: Valve types specified for low-pressure compressed air.
a. Equipment Isolation NPS 2 (DN 50) and Smaller: Safety-exhaust, copper-alloy ball valve with exhaust vent and pressure rating at least as great as piping system operating pressure.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping concealed from view and protected from physical contact by building occupants, unless otherwise indicated and except in rooms with no ceilings, equipment rooms and service areas.

C. Install piping indicated to be exposed at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and to coordinate with other services occupying that space.

E. Install piping adjacent to equipment and machines to allow service and maintenance.

F. Install air and drain piping with 1 percent slope downward in direction of flow.

G. Install nipples, flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating, unless otherwise indicated.

H. Equipment and Specialty Flanged Connections:
   1. Use steel companion flange with gasket for connection to steel pipe.
   2. Use cast-copper-alloy companion flange with gasket and soldered joint for connection to copper tube. Do not use soldered joints for connection to air compressors or to equipment or machines producing shock or vibration.

I. Install eccentric reducers where compressed-air piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.

J. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.

K. Install pressure gage on discharge piping from each air compressor and on each receiver. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping."

L. Install piping to permit valve servicing.

M. Install piping free of sags and bends.

N. Install fittings for changes in direction and branch connections.

O. Install sleeves for piping penetrations of walls, ceilings, and floors.

P. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.4 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Dissimilar Metal Piping Material Joints: Use dielectric fittings.

3.5 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping."

B. Install shutoff valves and unions or flanged joints at compressed-air piping to air compressors.

C. Install shutoff valve at inlet to each automatic drain valve, filter, lubricator, and pressure regulator.

D. Install check valves to maintain correct direction of compressed-air flow to and from compressed-air piping specialties and equipment.

3.6 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. NPS 2 (DN 50) and Smaller: Use dielectric unions.

3.7 FLEXIBLE PIPE CONNECTOR INSTALLATION

A. Install flexible pipe connectors in discharge piping and at inlet air piping from remote air-inlet filter of each air compressor.

B. Install bronze-hose flexible pipe connectors in copper compressed-air tubing.

3.8 SPECIALTY INSTALLATION

A. Install safety valves on receivers in quantity and size to relieve at least the capacity of connected air compressors.

B. Install air-main pressure regulators in compressed-air piping at or near air compressors.

C. Install automatic drain valves on receivers, and dryers. Discharge condensate onto nearest floor drain.

D. Install quick couplings at piping terminals for hose connections.

3.9 CONNECTIONS

A. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment and machine.

3.10 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.

B. Vertical Piping: MSS Type 8 or 42, clamps.

C. Individual, Straight, Horizontal Piping Runs:
   1. 100 Feet (30 m) or Less: MSS Type 1, adjustable, steel clevis hangers.

2. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.

D. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

E. Base of Vertical Piping: MSS Type 52, spring hangers.

F. Support horizontal piping within 12 inches (300 mm) of each fitting and coupling.

G. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1/4 (DN 8): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 3/8 and NPS 1/2 (DN 10 and DN 15): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
3. NPS 3/4 (DN 20): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
4. NPS 1 (DN 25): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
5. NPS 1-1/4 (DN 32): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
6. NPS 1-1/2 (DN 40): 10 feet (3 m) with 3/8-inch (10-mm) rod.

I. Install supports for vertical copper tubing every 10 feet (3 m).

3.11 LABELING AND IDENTIFICATION

A. Install identifying labels and devices for general-service compressed-air piping, valves, and specialties. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.12 FIELD QUALITY CONTROL

A. Perform field tests and inspections.

B. Tests and Inspections:
1. Piping Leak Tests for Metal Compressed-Air Piping: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air or gaseous nitrogen to pressure of 50 psig (345 kPa) above system operating pressure, but not less than 150 psig (1035 kPa). Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
2. Repair leaks and retest until no leaks exist.
3. Inspect filters and pressure regulators for proper operation.

C. Prepare test reports.

END OF SECTION 221513

SECTION 221519 - GENERAL-SERVICE PACKAGED AIR COMPRESSORS AND RECEIVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Lubricated, reciprocating air compressors.
   2. Inlet-air filters.
   3. Hose Reels.

1.3 DEFINITIONS

A. Actual Air: Air delivered from air compressors. Flow rate is delivered compressed air measured in acfm (actual L/s).

B. Standard Air: Free air at 68 deg F (20 deg C) and 1 atmosphere (29.92 in. Hg) before compression or expansion and measured in scfm (standard L/s).

1.4 SUBMITTALS

A. Product Data: For each type of product.
   1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:
   1. Include diagrams for power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For compressed-air equipment to include in emergency, operation, and maintenance manuals.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASME Compliance: Fabricate and label receivers to comply with ASME Boiler and Pressure Vessel Code.

2.2 GENERAL REQUIREMENTS FOR PACKAGED AIR COMPRESSORS AND RECEIVERS

A. General Description: Factory-assembled, -wired, -piped, and -tested; electric-motor-driven; air-cooled; continuous-duty air compressors and receivers that deliver air of quality equal to intake air.

B. Receivers: Steel tank constructed according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
   1. Pressure Rating: At least as high as highest discharge pressure of connected compressors, and bearing appropriate code symbols.
   2. Accessories: Include safety valve, pressure gage, drain, and pressure-reducing valve.

C. Mounting Frame: Fabricate mounting and attachment to pressure vessel with reinforcement strong enough to resist packaged equipment movement during a seismic event when base is anchored to building structure.

2.3 LUBRICATED, RECIPROCATING AIR COMPRESSORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the following: Speedaire or approved equal.

B. Compressor: 4ME98, simplex reciprocating air compressor, mounted on 60 gallon vertical tank.
   1. Cast iron crankcase, cylinders and fan type flywheel.
   2. 3ph, 60 hz motor, OSHA style belt guard, pressure switch for stop start control.
   3. Tank & pressure relief valve, manual tank drain, pressure gauge in receiver.
   4. Splash lubrication system.
   5. Inlet air filter/silencer.

C. Capacities and Characteristics:
   1. Air Compressor(s): Single stage.
   2. Actual-Air Capacity: 14.2 acfm (actual L/s) at 140 psig delivered. Set unit to deliver 100 psi.
   3. Discharge-Air Pressure: 100 psig (690 kPa).
   4. Mounting: Tank mounted.
   5. Motor (Each Air Compressor):
      a. Horsepower: 5.0 motor.
   6. Electrical Characteristics:
      a. Volts: 208.
      b. Phase(s): Three.
      c. Hertz: 60.
   7. Receiver: Steel tank.
      a. Arrangement: Vertical.
      b. Capacity: 60 gallon.
      c. Drain: Manual valve.

D. Specialties:

1. Particulate filter: Wilkerson model F28-06-SK00, 3/4" NPT, rated 130.0 scfm @ 100 psig.
2. Coalescing Filter: Wilkerson model M30-06-S00 3/4" NPT, rated 140 scfm @ 100 psig.
3. Regulator in-line Wilkerson model R28-06-F000, 3/4" NPT with gauge 100 scfm @ 100 psig.

2.4 HOSE REELS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the following: Reelcraft model 7850 OLPSW57 1 or approved equal.

B. Description: Wall mounted, Heavy Duty Spring Retractable Hose Reel.
1. Reinforced Steel - The steel guide arm and base are stamped with ribs and gussets to insure maximum strength and lightest possible weight.
2. Full Flow Stress Free Swivel design - The full flow swivel combines the highest grade seal design and materials with bearing areas to insure maximum service life. The hose is plumbed into the base to eliminate the risk of undue stress on the swivel.
3. Long Life Drive Spring - Declutching arbor virtually eliminates possibility of spring damage due to reverse winding. Only the highest quality spring steel is used and conditioned to insure there are no imperfections offering maximum service life.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Equipment Mounting: Install air compressor on concrete base using elastomeric pads. Comply with requirements in Division 03 Section 033000 "Cast-in-Place Concrete."
1. Minimum Deflection: 1/4 inch (6 mm).
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.

B. Install compressed-air equipment anchored to substrate.

C. Arrange equipment so controls and devices are accessible for servicing.

D. Maintain manufacturer's recommended clearances for service and maintenance.

E. Install the following devices on compressed-air equipment:
1. Pressure Gage, and Safety Valve: Install on each compressed-air receiver.
2. Pressure Regulators: Install downstream from air compressor.
3. Automatic Drain Valves: Install on receivers. Discharge condensate over nearest floor drain.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Division 22 Section "General-Service Compressed-Air Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to machine, allow space for service and maintenance.

3.3 IDENTIFICATION

A. Identify general-service air compressors and components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.
   2. Check for lubricating oil in lubricated-type equipment.
   3. Check belt drives for proper tension.
   4. Verify that air-compressor inlet filters and piping are clear.
   5. Check for equipment vibration-control supports and flexible pipe connectors, and verify that equipment is properly attached to substrate.
   6. Check safety valves for correct settings. Ensure that settings are higher than air-compressor discharge pressure, but not higher than rating of system components.
   7. Drain receiver tanks.
   8. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   9. Test and adjust controls and safeties.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air compressors.

END OF SECTION 221519

SECTION 221613 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Pipes, tubes, and fittings.
   2. Piping specialties.
   3. Piping and tubing joining materials.
   4. Valves.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:
   1. Piping and Valves: 40 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressure within Building:
   1. Downstream of the exterior gas meter to the emergency generator: 2 psi.
   2. Downstream of the exterior gas meter to the building: 7” water column.

1.5 SUBMITTALS

A. Product Data: For each type of the following:
   1. Piping specialties.
   2. Corrugated, stainless-steel tubing with associated components.
   3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
   4. Dielectric fittings.
   5. Escutcheons.

1.6 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

1.8 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:

C. Notify Owner no fewer than two days in advance of proposed interruption of natural-gas service.

D. Do not proceed with interruption of natural-gas service without Owner's written permission.

1.9 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
   1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
   2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
   3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
   4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
      a. Material Group: 1.1.
      b. End Connections: Threaded or butt welding to match pipe.
      c. Lapped Face: Not permitted underground.
      d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.

2.2 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.3 MANUAL GAS SHUTOFF VALVES

A. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller: Comply with ASME B16.33.
   1. CWP Rating: 125 psig (862 kPa.
   2. Threaded Ends: Comply with ASME B1.20.1.
   3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
   4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
   5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
   6. Service Mark: Valves 1-1/4 inches (32 mm) to NPS 2 (DN 50) shall have initials "WOG" permanently marked on valve body.
   7. Service Mark: Initials "WOG" shall be permanently marked on valve body.

B. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
   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. Watts
      b. Nibco
      c. Conbraco Industries, Inc.; Apollo Div.
   2. Body: Bronze, complying with ASTM B 584.
   3. Ball: Chrome-plated bronze.

4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig (4140 kPa).
9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.4 DIELECTRIC FITTINGS

A. Dielectric Unions:
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. Capitol Manufacturing Company.
   b. Central Plastics Company.
   c. Hart Industries International, Inc.
   d. McDonald, A. Y. Mfg. Co.
   e. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
   f. Wilkins; Zurn Plumbing Products Group.
2. Minimum Operating-Pressure Rating: 150 psig 1034 kPa.
3. Combination fitting of copper alloy and ferrous materials.
4. Insulating materials suitable for natural gas.
5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.5 SLEEVES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.6 ESCUTCHEONS

A. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to fit around pipe or tube, and OD that completely covers opening.

B. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Escutcheons: With set screw.
1. Finish: Polished chrome-plated.

2.7 LABELING AND IDENTIFYING

A. Gas piping shall be labeled.

B. Gas piping with 2 psi pressure shall be indicated at each label location.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

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

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to NFPA 54 and the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with NFPA 54and the International Fuel Gas Code requirements for prevention of accidental ignition.

3.3 PIPING INSTALLATION

A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Locate valves for easy access.

F. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install escutcheons at penetrations of interior walls, ceilings, and floors.
   1. New Piping:
      a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
      b. Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
      c. Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.

d. Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
e. Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type and set screw.
f. Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
g. Piping in Equipment Rooms: One-piece, cast-brass type.
h. Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

J. Verify final equipment locations for roughing-in.

K. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

L. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

M. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

N. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

O. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.
1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
2. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
a. Exception: Tubing passing through partitions or walls does not require striker barriers.
3. Prohibited Locations:
a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
b. Do not install natural-gas piping in solid walls or partitions.

P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

Q. Connect branch piping from top or side of horizontal piping.

R. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

S. Do not use natural-gas piping as grounding electrode.

T. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

U. Install pressure gage upstream and downstream from each line regulator.

3.4 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance

B. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

3.5 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:
1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:
1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hangers and supports specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
1. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches (2438 mm); minimum rod size, 3/8 inch (10 mm).
2. NPS 1-1/4 (DN 32): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).

4. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Maximum span, 10 feet (3 m); minimum rod size, 1/2 inch (13 mm).
5. NPS 4 (DN 100) and Larger: Maximum span, 10 feet (3 m); minimum rod size, 5/8 inch (15.8 mm).

3.7 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches (1800 mm) of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.8 LABELING AND IDENTIFYING

A. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.9 PAINTING

A. Comply with requirements in Division 09 Section “Painting” for painting interior and exterior natural-gas piping.

B. Paint exposed, exterior metal piping, 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 (semigloss).
    d. Color: Gray.

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. Perform tests and inspections.

B. Tests and Inspections:
1. Test, inspect, and purge natural gas according to NFPA 54and the International Fuel Gas Code and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.11 OUTDOOR PIPING SCHEDULE

A. Underground natural-gas piping shall be one of the following:
   1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.

B. Aboveground natural-gas piping shall be the following:
   1. Steel pipe with wrought-steel fittings and welded joints.

3.12 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG (3.45 kPa)

A. Aboveground, distribution piping shall be one of the following:
   1. Steel pipe with malleable-iron fittings and threaded joints.
   2. Steel pipe with wrought-steel fittings and welded joints.

3.13 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 (DN 50) and smaller at service meter shall be the following:
   1. Bronze plug valve.

B. Distribution piping valves for pipe sizes NPS 2 (DN 50) and smaller shall be the following:
   1. Two-piece, full-port, bronze ball valves with bronze trim.

C. Valves in branch piping for single appliance shall be the following:
   1. Two-piece, full-port, bronze ball valves with bronze trim.

END OF SECTION 221613

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SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Electric, domestic-water heaters.
   2. Thermostat-control, electric, tankless, domestic-water heaters.
   3. Domestic-water heater accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated.

B. Shop Drawings:
   1. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For commercial domestic-water heaters, 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. Product Certificates: For each type of electric, domestic-water heater, from manufacturer.

C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

D. Source quality-control reports.

E. Field quality-control reports.

F. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, 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.
      a. Electric, Storage, Domestic-Water Heaters:
         1) Storage Tank: Five years.
         2) Controls and Other Components: Two years.
      b. Electric, Tankless, Domestic-Water Heaters: Five year(s).

PART 2 - PRODUCTS

2.1 WATER HEATING AND TEMPERING EQUIPMENT

A. Water Heating/Tempering Equipment: WHTR-1
   1. Basis-of-Design Product: Provide Hubbell model EMV120-85-4.5SL-R
   2. Description:
      a. Factory packaged system designed to meet the requirements of ANSI Z358.1-2004 for tepid water delivery to an emergency drench system. The water heater is constructed of a carbon steel tank and internally lined with 1/2" thick Hydrastone

cement and is fully insulated with 3" thick polyurethane foam to minimize stand-by heat loss. The water heater is packaged with a mixing valve specifically designed, tested and proven for use in emergency safety shower/face/eyewash applications. The entire package including the mixing valve is factory piped and mounted to the water heater to provide single source responsibility.

b. Packaged with the Hubbell model EMV is a triple redundant, thermostatic pressure balanced valve designed specifically for emergency safety shower/face/eyewash applications. The valve is factory mounted and piped to the water heater. After water flow is activated at the emergency station, the outlet water temperature from the model EMV package will be maintained at 85°F tepid temperature. The Hubbell EMV is able to achieve the high volume demand required for a safety drench system by mixing the 170°F water in the tank with incoming cold water. The mixing valve meets OSHA and ANSI requirements and is capable of providing constant 85°F output regardless of inlet pressure and temperature variations, and the temperature setting is tamper proof and cannot be inadvertently adjusted in the field. The valve is capable of providing a full range of flows from a flow of 0.4 GPM for an eyewash to the combined 23 GPM flow for a simultaneous demand of shower, eyewash, and face wash system.

c. Electrical Connection: 208 v. 3 phase

d. Water connections:
   1) Inlet: 1-1/2" NTP female.
   2) Tempered Outlet: 1-1/4" NPT female

e. Storage capacity: 120 gallons

f. Relief Valve: ¾", T & P 210 degree f, 160 psi.

g. Warranty: 5 year non pro-rated.

2.2 ELECTRIC, TANKLESS, DOMESTIC-WATER HEATERS

A. Thermostat-Control, Electric, Tankless, Domestic-Water Heaters: WHTR-2

1. Basis of Design: EEMAX, ProAdvantage model PA018208T2T.
2. Standard: UL 499 for electric, tankless, (domestic-water heater) heating appliance.
3. Construction: Copper piping or tubing complying with NSF 61 Annex G barrier materials for potable water, without storage capacity.
   a. Connections: ASME B1.20.1 pipe thread.
   b. Pressure Rating: **150 psig (1035 kPa)**.
   c. Heating Element: Resistance heating system.
   d. Temperature Control: Digital touchpad with LED temperature display.
   e. Safety Control: High-temperature-limit cutoff device or system.
   f. Jacket: Aluminum or steel with enameled finish or plastic.
4. Support: Bracket for wall mounting.
5. Capacity and Characteristics:
   a. Flow Rate: 1.5 **gpm** at **82 deg F** temperature rise.
   b. Minimum flow rate: 0.7 gpm.
   c. Temperature Setting: **110 deg F**.
   d. Power Demand: 18.0.
   e. Electrical Characteristics:
      1) Volts: 208.
      2) Phases: Three.
      3) Hertz: 60.
      4) Amperes: 50A/phase.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Electric, Domestic-Water Heater Mounting: Install electric, domestic-water heaters on concrete base.
   1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
   2. Maintain manufacturer's recommended clearances.
   3. Arrange units so controls and devices that require servicing are accessible.
   4. Install anchor bolts to elevations required for proper attachment to supported equipment.
   5. Anchor domestic-water heaters to substrate.

B. Electric, Domestic-Water Heater Mounting: Install electric, domestic-water heaters on domestic-water heater mounting bracket.
   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.

C. Electric, Tankless, Domestic-Water Heater Mounting: Install electric, tankless, domestic-water heaters on wall bracket.
   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.

D. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."

E. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-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.

F. Install combination temperature-and-pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend commercial-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.

G. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

H. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

I. Install thermometers on inlet and outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

J. Fill electric, domestic-water heaters with water.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
   2. Leak Test: After installation, charge system 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 operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Owner's maintenance personnel to adjust, operate, and maintain electric, domestic-water heaters and tankless, electric, domestic-water heaters.

END OF SECTION 223300

SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following conventional plumbing fixtures and related components:
   1. Faucets for lavatories and sinks.
   2. Fixture supports.
   3. Water closets.
   4. Lavatories.
   5. Stainless steel sink.
   6. Service Basin.

B. Related Sections include the following:
   1. Division 10.
   2. Division 22 Section "Domestic Water Piping Specialties" and “Sanitary Waste Piping Specialties” for backflow preventers, floor drains, and specialty fixtures not included in this Section.
   3. Division 22 Section "Emergency Plumbing Fixtures."

1.3 DEFINITIONS

A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

C. FRP: Fiberglass-reinforced plastic.

D. PVC: Polyvinyl chloride plastic.

E. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.4 SUBMITTALS

A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
   1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

F. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
   1. Plastic Mop-Service Basins: ANSI Z124.6.
   2. Stainless-Steel Sinks: ASME A112.19.3.
   3. Vitreous-China Fixtures: ASME A112.19.2M.

G. Comply with the following applicable standards and other requirements specified for sink faucets:
   1. Faucets: ASME A112.18.1.
   2. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
   3. NSF Potable-Water Materials: NSF 61.
   4. Pipe Threads: ASME B1.20.1.
   5. Supply Fittings: ASME A112.18.1.
   6. Brass Waste Fittings: ASME A112.18.2.

H. Comply with the following applicable standards and other requirements specified for shower faucets:
   1. Faucets: ASME A112.18.1.
   2. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
   3. Hose-Coupling Threads: ASME B1.20.7.
   4. Manual-Control Antiscald Faucets: ASTM F 444.
   5. Pipe Threads: ASME B1.20.1.

I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
   1. Atmospheric Vacuum Breakers: ASSE 1001.
   2. Brass and Copper Supplies: ASME A112.18.1.
   3. Brass Waste Fittings: ASME A112.18.2.

J. Comply with the following applicable standards and other requirements specified for miscellaneous components:
   1. Flexible Water Connectors: ASME A112.18.6.
   2. Floor Drains: ASME A112.6.3.
   3. Hose-Coupling Threads: ASME B1.20.7.
   4. Off-Floor Fixture Supports: ASME A112.6.1M.
   5. Pipe Threads: ASME B1.20.1.
   6. Plastic Toilet Seats: ANSI Z124.5.
   7. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components of whirlpools that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures of unit shell.
      b. Faulty operation of controls, blowers, pumps, heaters, and timers.
      c. Deterioration of metals, metal finishes, and other materials beyond normal use.
   2. Warranty Period for Commercial Applications: Three year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LAVATORY FAUCETS

A. Lavatory Faucets : L-1:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn, model Z81101-17M-XL faucet.
   2. Description: Polished chrome-plated cast brass faucet body with integral shanks, quarter turn ceramic disc cartridges and a 4" long integral cast spout. Unit is furnished with a 1.5 pressure compensating aerator (complying with ANSI A112.18.1 Standard for flow), 2-1/2" vandal-resistant color coded metal lever handles, mounting hardware and 1/2" NPSM coupling nuts for standard lavatory risers.
      a. Body Material: Commercial, lead free solid brass.
      b. Finish: Polished chrome plate.
      c. Maximum Flow Rate: 1.5 gpm Vandal-Resistant Pressure Compensating Male Aerator.
      d. Mounting: Deck.
      e. Valve Handle: None.
      f. Inlet(s): NPS 3/8 (DN 10) tubing, with NPS 1/2 (DN 15) male adaptor.
      g. Spout: Rigid type.
      h. Operation: Manual lever handles.
      i. Drain: Grid model McGuire model 1149WC offset with flat grid strainer.

2.2 SINK FAUCETS

A. Sink Faucets: SK-1.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   2. Basis-of-Design Product: Subject to compliance with requirements, provide Chicago Faucet or a comparable product by one of the following:
      a. American Standard Companies, Inc.
      b. Chicago Faucets.
      c. Moen, Inc.
      d. Zurn Plumbing Products Group; Commercial Brass Operation.
   3. Description: Chicago Faucet, Model 631-XKCP, polished chrome brass widespread, 8" swing gooseneck spout, quarter turn ceramic disc cartridges, 1.5 gpm aerator. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
      a. Body Material: General-duty, solid brass.
      b. Finish: Polished chrome plate.
      c. Maximum Flow Rate: 1.5 gpm, unless otherwise indicated.
      d. Centers: 8 inches (102 mm).
      e. Mounting: Deck.
      f. Handle(s): Lever.
      g. Inlet(s): NPS 3/8 (DN 10) tubing with NPS 1/2 (DN 15) male adapter.
      h. Spout Type: 8" Swing gooseneck.
      i. Spout Outlet: Aerator.
      j. Vacuum Breaker: Not required.
      k. Operation: Noncompression, manual.
      l. Drain: See sink.

2.3 FIXTURE SUPPORTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide Zurn or one of the following:
   1. MIFAB Manufacturing Inc.
   2. Smith, Jay R. Mfg. Co.
   3. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
   4. Zurn Plumbing Products Group; Specification Drainage Operation.

2.4 WATER CLOSETS

A. Water Closets, WC-1:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn, model Z5562, or a comparable product by one of the following:
      a. Zurn
   2. Description: Dual flush, pressure assist, ADA height, elongated bowl, two-piece toilet.
      a. Supply: 1/2" chrome-plated brass or copper with screwdriver stop.
      b. Style: Tank type with manual flush lever handle.
         1) Bowl Type: Wall hung, elongated with high efficiency siphon-jet design.
         2) Design Consumption: 1.0 gal./flush "low flush", 1.6 gal./flush "full flush".
         3) Color: White.

2.5 TOILET SEATS

A. Toilet Seats.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   2. Basis-of-Design Product: Subject to compliance with requirements, provide Church or a comparable product by one of the following:
      a. American Standard Companies, Inc.
      b. Bemis Manufacturing Company.
      c. Church Seats.
      d. Kohler Co.
      e. Zurn.
   3. Description: Model 9500C, Toilet seat for water-closet-type fixture.
      a. Material: Molded, solid plastic.
      b. Configuration: Open front without cover.
      c. Size: Elongated.
      d. Hinge Type: CK, check.
      e. Class: Heavy-duty commercial.
      f. Color: White.

2.6 LAVATORIES

A. Lavatory L-1:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn, model Z5314 wall hung with concealed carrier or a comparable product by one of the following:
      a. Zurn.
   2. Description: Accessible, wall-mounting, vitreous-china fixture.
      a. Size: 20 by 18 inches 508 by 457 mm rectangular.
      b. Faucet Hole Punching: Two holes, 4-inch (102-mm) centers.
      c. Color: White.
      d. Supplies: NPS 3/8 (DN 10) chrome-plated copper with stops.
      e. Drain: Grid strainer.
      f. Drain Piping: NPS 1-1/4 by NPS 1-1/2 (DN 32 by DN 40) chrome-plated, cast brass P-trap; NPS 1-1/2 (DN 40) tubular brass waste to wall; and wall escutcheon.
      g. Provide TrueBro insulation system on exposed piping.

2.7 COMMERCIAL SINKS

A. Commercial Sinks, SK-1:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   2. Basis-of-Design Product: Subject to compliance with requirements, provide Advance Tabco or a comparable product by one of the following:
      a. Elkay Manufacturing Co.
      b. Just Manufacturing Company.
      c. Advance Tabco.
      d. Description: Model 6-41-24, 600 series, single compartment, commercial sink, floor mounted on four galvanized steel legs with adjustable feet.
      e. Overall Dimensions: 24” left to right x 27-1/2” front to back.
      f. Metal Thickness: 16 gauge, 304 stainless steel.
      g. Faucet holes: Two.

h. Compartments:
   1) Dimensions: 24” left to right by 24” front to back by 14” deep.
   2) Drain: Removable cup drain.
      a) Location: Near back of compartment.
i. Faucet(s): Sink SK-1.
   1) Number Required: One.
   2) Mounting: Backsplash.
j. Supplies: NPS 1/2 (DN 15) chrome-plated copper with ball valve stops or shutoff valves.
k. Drain Piping: NPS 1-1/2 (DN 40) chrome-plated, cast-brass P-trap; tubular brass waste to wall; and wall escutcheon(s).
l. Include integral stops in shanks, vacuum breaker, hose-thread outlet, and pail hook. Exposed drainage piping below the sink shall be DWV copper tubing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

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

3.2 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

C. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

D. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."

E. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

3.4 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Operate and adjust high temperature limit stops on faucets. Replace damaged and malfunctioning units.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
   1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
   2. Remove sediment and debris from drains.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities.

END OF SECTION 224000

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SECTION 224500 - EMERGENCY PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following emergency plumbing fixtures:
   1. Combination units.

B. Related Sections include the following:
   1. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers.
   2. Division 22 Section "Sanitary Waste Piping Specialties" for floor drains.

1.3 DEFINITIONS

A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.

C. Tepid: 60 degrees f to 90 degrees f.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Product Certificates: Submit certificates of performance testing specified in "Source Quality Control" Article.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For emergency plumbing fixtures to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."

C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act" ; and Public Law 101-336, "Americans with Disabilities Act" ; for plumbing fixtures for people with disabilities.

D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

1.6 EYE/FACE WASH EQUIPMENT

A. Combination Eyewash/Shower Station:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   2. Basis-of-Design Product: Subject to compliance with requirements, provide Guardian model GFB 1909SSH-BC or a comparable product by one of the following:
      a. Encon Safety Products.
      b. Guardian Equipment Co.
      c. Speakman Company.
   3. Description: Barrier-Free combination eye/face wash and shower safety station. Shower head and pull rod are extended for improved access. Bowl is lowered and extended to permit access by wheelchair user. Bowl will have optional -BC stainless steel cover. Profile of unit is “flattened” to comply with maximum height and knee clearance requirements.
      a. Capacity: Deliver potable water at rate not less than 23.0 gpm for at least 15 minutes.
      b. Supply Piping shower valve: NPS 1” with flow regulator and stay-open control valve.
      c. Supply Piping eyewash valve: NPS 1/2” with flow regulator and stay-open control valve.
      d. Eyewash Control-Valve Actuator: Paddle.
      e. Shower Control-Valve Actuator: Pull-down rod and handle.
      f. Receptor: Stainless-steel bowl.
      g. Drain Piping: NPS 1-1/4 (DN 32) minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2.

1.7 SOURCE QUALITY CONTROL

A. Certify performance of plumbed emergency plumbing fixtures by independent testing agency acceptable to authorities having jurisdiction.

PART 2 - EXECUTION

2.1 EXAMINATION

A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

2.2 EMERGENCY PLUMBING FIXTURE INSTALLATION

A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.

B. Install fixtures level and plumb.

C. Fasten fixtures to substrate.

D. Install shutoff valves in water-supply piping to fixtures. Use ball, gate, or globe valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
   1. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.

E. Install thermometers in supply and outlet piping connections to water-tempering equipment. Thermometers are specified in Division 22 Section "Meters and Gages for Plumbing Piping."

F. Install trap and waste to wall on drain outlet of fixture receptors that are indicated to be directly connected to drainage system.

G. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."

H. Install equipment nameplates or equipment markers on fixtures and equipment signs on water-tempering equipment. Identification materials are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

2.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect hot- and cold-water-supply piping to hot- and cold-water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures.

C. Directly connect emergency plumbing fixture receptors with trapped drain outlet to sanitary drainage and vent piping.

2.4 FIELD QUALITY CONTROL

A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities and temperatures.

B. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

C. Report test results in writing.

2.5 ADJUSTING

A. Adjust or replace fixture flow regulators for proper flow.

B. Adjust equipment temperature settings.

END OF SECTION 224500

SECTION 230500 – COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provide labor, materials, accessories, and other related items as required to complete operations in connection with the complete installation of the HVAC and mechanical systems as indicated on the Drawings and as specified herein.

1.2 RELATED REQUIREMENTS

A. Conditions of the contract apply to the work, including the work of this Division. Examine Contract Documents for requirements affecting the work.

1.3 MECHANICAL PRE-CONSTRUCTION MEETING

A. Conduct a mechanical conference at Project site to comply with requirements of Division 01 Section "Project Management and Coordination" and the following:
   1. At least 14 days prior to beginning of mechanical work, conduct a meeting to review detailed requirements for mechanical systems installation and testing requirements. Review mechanical Drawings and Specifications, discuss project specific details and requirements, and review and discuss expectations for quality control. Establish preliminary work progress schedule and procedures for materials inspection, testing, and certifications. Require representatives of each entity directly concerned with mechanical systems installation to attend conference, including, but not limited to, the following:
      a. Owner's Representative serving as General Contractor's superintendent.
      b. Mechanical Subcontractors project managers.
      c. Mechanical Subcontractors job foremen.
      d. Controls job foreman.
      e. Project Manager/Mechanical Engineer.

1.4 DRAWINGS

A. The general location of the apparatus and the details of the work are indicated on the Drawings. Exact locations not indicated shall be determined at the site as the work progresses and shall be subject to the Architect's approval.

B. It is not intended that the Drawings shall show every pipe, pipe rise, pipe drop, duct rise, duct drop, pipe fitting, duct fitting, or appliance, but it shall be a requirement to furnish, without additional expense, material and labor necessary to complete the systems in accordance with the design intent and with the highest possible quality available.

1.5 ALTERATIONS

A. Execute alterations, additions, removals, relocations, new work, and other related items as indicated or required to provide a complete installation in accordance with the intent of the Contract Documents, including changes required by building alterations.

B. Existing work disturbed or damaged by the alterations or the new work shall be repaired or replaced to the Architect's satisfaction and at no additional cost to the Owner.

C. Existing ductwork, piping, and other systems indicated to be removed, shall be removed from the site. Cap off existing services remaining. The Owner retains the right to ownership of heating and ventilating equipment scheduled to be removed; store such equipment where requested by the Owner. Material not retained by the Owner shall be removed from the site.

1.6 CONTINUITY OF SERVICE

A. Arrange to execute the work at such times and in such locations as may be required to provide uninterrupted service for the building or any of its locations. Any unavoidable conditions requiring reduced building capacity shall be arranged for by programming with the Owner's duly authorized representative at the building subject to the Architect's approval. If necessary, temporary work shall be installed to provide for the condition. Authorization for interrupting service shall be obtained in writing from the Owner. Any interruption of normal service shall be performed during an overtime period to be scheduled with the Owner. Costs for overtime work shall be included in the bid.

1.7 REQUIREMENTS

A. Installation Instructions: Obtain manufacturer's printed installation instructions to aid in properly executing work on major pieces of equipment. Install equipment in accordance with manufacturer’s recommendations.

B. Objectionable Noise, Fumes and Vibration:
1. Mechanical and electrical equipment shall operate without creating objectionable noise, fumes, or vibration, as determined by the Architect.
2. If such objectionable noise, fumes, or vibration is produced and transmitted to occupied portions of building by apparatus, piping, ducts, or any other part of mechanical and electrical work, make necessary changes and additions, as approved, without extra cost to Owner.

C. Equipment Design and Installation:
1. Uniformity: Unless otherwise specified, equipment or material of same type or classification, used for same purposes, shall be product of same manufacturer.
2. Design: Equipment and accessories not specifically described or identified by manufacturer's catalog number shall be designed in conformity with ASME, IEEE, or other applicable technical standards, suitable for maximum working pressure, and with neat and finished appearance.
3. Installation: Erect equipment aligned, level and adjusted for satisfactory operation. Install so that connecting and disconnecting of piping and accessories can be made readily, and so that parts are easily accessible for inspection, operation, maintenance and repair. Minor deviations from indicated arrangements may be made, as approved.

D. Hanging of Equipment, Ductwork and Piping:
1. Support equipment, ductwork and piping from the top chord of bar joists at the APanel Points@ or from the top flange of beams. Piping 2" (51 mm) nominal and smaller may be supported from the bottom chord of the bar joists at the APanel Points@ or from the bottom flange of the beams.

E. Protection of Equipment and Materials: Responsibility for care and protection of materials and mechanical work rests with the Contractor until the entire project has been completed, tested and the project is accepted by the Owner.

F. Foundations:
   1. Ceiling Mounting: Where ceiling mounting is indicated or specified, use suspended platform or strap hangers, bracket or shelf, whichever is most suitable for equipment and its location. Construct of structural steel members, steel plates, or rods, as required; brace and fasten to building structure or to inserts as approved, or as detailed.
   2. Where floor mounting is indicated, locate equipment on 4 inch (102 mm) high reinforced concrete pad of adequate size with anchors and base plates as required, on pressure-treated sleepers, or on structural steel frame as detailed. The corners of pads shall be chamfered 1/2 inch (13 mm). Pad and steel sizes and location shall be coordinated with the approved equipment.

1.8 ELECTRIC WORK

A. Provide motors, pilot lights, controllers, limit switches, and other related items for equipment provided under Division 23.

B. Except as noted, required line switches, fused switches, and other related items and necessary wiring to properly connect equipment to motors and switches shall be furnished and installed under Division 26, Electric.

C. Wiring shall conform to the requirements of the National Electrical Code.

1.9 FIRESTOPPING

A. Firestopping for penetrations of ductwork, piping and equipment through fire rated and smoke rated building assemblies, including but not limited to partitions, walls, floors, ceilings, and roofs, shall be furnished and installed under this Section.

B. Selection of firestopping materials and installation of firestopping materials shall be in accordance with Division 07 Section “Through Penetration Firestopping Systems.” Coordinate with other trades for a consistent installation.

C. Refer to Architectural Drawings for locations of fire rated building assemblies.

1.10 SUBMITTALS

A. After award of Contract and before installation, submit for approval Shop Drawings, bulletins, Product Data, Samples, and other related items.

B. Submit Shop Drawings and Product Data as required in each Section. Submittal shall include physical data and performance data required to verify compliance with the Contract Documents.

C. Submit Samples and Mock-Ups as required in each Section, and as indicated on the Drawings. These will generally be retained by the Architect/Engineer. Contractor may request these items returned; provide return shipping for returns.

1.11 SUBSTITUTIONS

A. Comply with provisions of the Instructions to Bidders and General Requirements.

B. The first item listed under "Acceptable Manufacturers", “Approved Manufacturers” or “Manufacturers” is the design basis.
   1. Other manufacturers listed may be used in the base bid, but conformance with details of the Specifications, as well as dimensional and electrical data, shall be verified by the Contractor.
   2. Architect/Engineer has not verified that each listed manufacturer has the ability to provide an acceptable substitution for the basis-of-design product. Contractor may not assume that substitutions will be approved.
   3. Modifications required as a result of differences between the design basis item and the submitted and approved item must be approved by the Architect and made at the Contractor's expense. As an example, if a rooftop HVAC unit is submitted and approved and if the units dimensions and weight are different from those of the unit which was used as the design basis, the Contractor shall be responsible for building structural modifications required to accommodate the submitted and approved unit, at no additional cost to the Owner.
   4. For items which have no manufacturers listed, any item conforming with the Contract Documents is acceptable.

C. Substitutions from manufacturers or providers which are not listed may be proposed within the time allowed in the General Conditions of the Specifications.
   1. The exception to this is products for which the list of manufacturers or providers is limited by the wording “no substitutions” or similar wording.

1.12 COORDINATION

A. Coordinate scheduling, submittals, and Work of the various Sections of Specifications to assure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Verify that utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various Divisions having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

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

D. In finished areas, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

E. Coordinate completion and clean-up of work of separate Sections in preparation for Substantial Completion.

F. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.13 REQUESTS FOR ARCHITECT’S CADD DRAWINGS

A. In lieu of generating their own CADD drawings, the Contractor may elect to use the Architect’s electronic copies of CADD drawings for the purpose of developing control system graphics or for other reasons that pertain to the requirements of this Contract. If the Contractor elects to utilize the Architect’s electronic copies of CADD drawings, the electronic files shall be purchased from

the Architect at the Architect's current billing rate per drawing. The Contractor shall provide payment and shall sign a release-of-liability form before electronic CADD drawings are released.

1.14 CLEANING

A. Remove debris from site daily.

B. Material and pieces of equipment shall be turned over to the Owner free of dust and dirt, both inside and out.

C. At the completion of the Project, equipment shall have a clean, neat appearance of factory finish by cleaning or repainting as required.

D. At the completion of the Project, surfaces exposed to view shall have a clean, neat appearance of finish free from smudges and scratches by cleaning or repainting as required.

1.15 STARTING SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Architect/Engineer seven days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions which may cause damage.

D. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify that wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of responsible manufacturer's representative in accordance with manufacturers instructions.

G. When specified in individual Specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

1.16 FACTORY START-UP AND START-UP REPORTS

A. Provide factory start-up of mechanical equipment listed below. Factory start-up shall be performed by a factory authorized representative of the equipment manufacturer. When factory start-up is successfully completed for each piece of mechanical equipment listed below, submit a formal start-up report to the Architect for approval. Start-up report shall be formatted in accordance with equipment manufacturer's recommendations. Start-up report shall be typed, not hand written, and shall be submitted in a clean and legible form.

B. Equipment requiring factory start-up
   1. Low pressure steam boiler control panels
   2. Deaerator tank and pumps
   3. Fuel oil transfer pumpset
   4. Building management system

1.17 ADJUSTMENTS AND OWNER'S INSTRUCTIONS

A. After completion of the installation work called for in the Contract Documents, furnish necessary mechanics or engineers for the adjustment and operation of the systems, to the end that the systems are perfectly adjusted and turned over to the Owner in perfect working order. Further instruct the Owner's authorized representative in the care and operation of the installation, providing framed instruction charts, directions, and other related items.

B. Instructors providing Owner training shall be experienced and familiar with the jobsite.

C. Perform other tests specified in individual Sections of this Specification.

1.18 COMPLETION OF SYSTEMS

A. The following mechanical systems shall not be complete until the following conditions are satisfied:
   1. Ductwork Systems:
      a. Boiler stacks and breeching.
      b. Installation of combustion air units and associated ductwork.
   2. Piping Systems:
      a. Low pressure steam tie-in to steam main.
      b. Tie-in to existing condensate lines entering Central Heating Plant from Campus.
      c. Relocation of chemical treatment piping and equipment.
      d. Fuel oil and gas piping run to dual-fuel burners.
      e. Boiler blow-down, pressure relief and feed-water piping.
   3. Equipment:
      a. Low pressure steam boilers and dual-fuel burners.
      b. Deaerator and feed-water pumps.
      c. Fuel oil transfer pumpset.
      d. Condensate receiver and duplex pumps.
      e. Blowdown flash tank.
      f. Three (3) combustion air units with fans and glycol hot water coils.
      g. Steam to glycol hot water heat exchanger.
      h. Hot water unit heaters.
   4. Automatic Temperature Controls (ATC):
      a. Boiler/burner control panel and wiring to devices.
      b. Interface with building management system.
      c. Commissioning shall be completed.
      d. ATC system shall operate in an automatic mode for a minimum of four (4) months during Owner occupancy without substantial deficiencies.

1.19 OPERATING AND MAINTENANCE MANUALS

A. Furnish two (2) bound operating and maintenance manuals and forward to the Architect for review and transmittal to the Owner.

B. For maintenance purposes, provide approved Submittals, parts lists, specifications, and manufacturer's maintenance bulletins for each piece of equipment. For materials used which have been submitted to the Architect for approval but do not require regular maintenance, such as piping, ductwork, and insulation, provide one copy of approved Submittals.

C. Provide name, address and telephone number of the manufacturer's representative and service company, for each piece of equipment or material so that service or spare parts can be readily obtained.

1.20 WARRANTY

A. Provide guarantees and warranties for work under this Contract as indicated in the general requirements of the Contract.

B. Provide manufacturers standard warranties and guarantees for work by the mechanical trades. However, such warranties and guarantees shall be in addition to and not in lieu of other liabilities which the manufacturer and the Mechanical Contractor may have by law or by other provisions of the Contract Documents.

C. Guarantee that elements of the systems provided under this Contract are of sufficient capacity to meet the specified performance requirements as set forth in these Specifications or as indicated on the Drawings.

D. Upon receipt of notice from the Owner of failure of any part of the mechanical systems or equipment during the warranty period, the Mechanical Subcontractor shall replace the affected part or parts.

E. Furnish a written guarantee covering the above requirements before submitting the application for final payment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 230500

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SECTION 230519 – METERS AND GAUGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pressure gauges and Pressure gauge taps.

B. Static pressure gauges.

C. Test Plugs.

D. Thermometers and thermometer wells.

1.2 RELATED SECTIONS

A. Division 23 Section “Hydronic Piping.”

B. Division 23 Section “Instrumentation and Controls for HVAC.”

1.3 REFERENCES

A. Division 01 Section “References”: Requirements for references and standards.

B. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.

C. ASME MFC-3M - Measurement of Fluid Flow in Pipes Using Orifice, Nozzle and Venturi.

D. ASTM E1 - Standard Specification for ASTM Thermometers.

E. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.

F. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.

G. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.

H. AWWA C702 - Cold-Water Meters - Compound Type.

I. AWWA C703 - Cold-Water Meters - Fire-Service Type.

J. AWWA C706 - Direct-Reading Remote-Registration Systems for Cold-Water Meters.

K. AWWA C710 - Cold-Water Meters - Displacement Type, Plastic Main Case.

L. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

M. UL 393 - Indicating Pressure Gauges for Fire-Protection Service.

N. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service.

1.4 SUBMITTALS

A. Division 01 Section “Submittal Procedures”: Procedures for submittals.

B. Product Data: Provide manufacturers data and list which indicates use, operating range, total range, accuracy, and location for manufactured components.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01 Section “Closeout Procedures.”

B. Project Record Documents: Record actual locations of components and instrumentation.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 01 Section “Operation and Maintenance Data.”

B. Include instructions for calibrating instruments.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Division 01 Section “Product Requirements”: Environmental conditions affecting products on site.

B. Do not install instruments when areas are under construction, except for required rough-in, taps, supports and test plugs.

C. Supply two bottles of red gauge oil for static pressure gauges.

PART 2 - PRODUCTS

2.1 PRESSURE GAUGES

A. Manufacturers:
1. Weiss Series NF4S-1.
2. Trerice No. 600 Series.
3. Marshalltown.
4. Amtek.
5. Dwyer.

B. Gauge: Non-filled type, ANSI-ASME B40.1 Grade 1A, with bourdon tube, rotary brass movement, brass socket, 1/4" NPT connection, front recalibration adjustment, black scale on white-finished metal background.
1. Case: 304 stainless steel.
2. Lens: Push-in clear acrylic with stainless steel ring, per manufacturer=s standard.
3. Bourdon Tube: Phosphor bronze.
4. Dial Size: 4 to 4-1/2 inch (101 to 114 mm).
5. Accuracy: One percent of full scale range.
6. Scale: Psi.
7. Range: [0-60] psig typical, select for application.

C. Verify suitability of range for each application. Best selection is for typical reading to be close to mid-scale.

2.2 PRESSURE GAUGE TAPPINGS

A. Ball Valve:
   1. Manufacturers:
      a. Weiss.
      b. Trerice.
      c. Marshalltown.
      d. Amtek.
      e. Dwyer.
   2. Brass, 1/4 inch (6 mm) NPT for minimum 300 psi, (2070 kPa).
   3. Ball valves may also be furnished under applicable sections of the Specifications.

B. Syphon:
   1. Manufacturers:
      a. Weiss.
      b. Trerice.
      c. Marshalltown.
      d. Amtek.
      e. Dwyer.
   2. Brass, 1/4 inch (6 mm) NPT angle or straight pattern.

2.3 STATIC PRESSURE GAUGES

A. Dial Gauges:
   1. Manufacturers:
      a. Dwyer.
      b. Trerice.
      c. Marshalltown.
      d. Amtek.
   2. 3-1/2 inch (89 mm) diameter dial in metal case, diaphragm actuated, black figures on white background, front recalibration adjustment, 2 percent of full scale accuracy.

B. Inclined Manometer:
   1. Manufacturers:
      a. Dwyer.
      b. Trerice.
      c. Marshalltown.
      d. Amtek.
   2. Plastic with red liquid on white background with black figures, front recalibration adjustment, 3 percent of full scale accuracy.

C. Accessories: Static pressure tips with compression fittings for bulkhead mounting, 1/4 inch (6 mm) diameter tubing.

2.4 TEST PLUGS

A. Test Plug:
   1. Manufacturers:
      a. Peterson Equipment Co., Inc., “Pete’s Plugs”. [www.petesplug.com]
      b. Weiss. [http://weissinstruments.com/]
      c. Flow Design, Inc. [www.flowdesign.com]
      d. Trerice. [http://www.trerice.com/]
   2. 1/2 inch (13 mm) NPT brass fitting and cap for receiving 1/8 inch (3 mm) outside diameter pressure or temperature probe with self-closing valves as follows:
      a. Nordel (EPDM) core for water and hydronic heating and cooling service, temperatures range 30 to 275 degrees F (-1 to 176 degrees C).
      b. Neoprene core for natural gas or LP gas service, temperature range -40 to 150 degrees F (-40 to 65 degrees C).
      c. Verify core suitability for other fluids and temperatures.
   3. Working Pressure: 500 psig
   4. Cap Retaining Strap: Color coded to indicate core material.
   5. Construction with either dual self-closing valves (Pete’s Plug standard design) or single valve are allowed.
   6. For chilled water applications, provide “XL” plugs which include a 1-1/2" (38 mm) extension for insulated piping.

B. Pressure and Temperature Test Kit: Furnish one (1) to the Owner.
   1. Carrying case with inside foam padding.
   2. Pressure gauge, liquid filled with 1/4" (6 mm) NPT connection, range 0 to 100 psig (0 to 700 kPa), with gauge adapter attached.
   3. Additional gauge adapter with 1/8" (3 mm) diameter probe and protecting shield.
   4. Bimetal thermometer, range 25 to 125 degrees F (-5 to 50 degrees C), 5 inch (127 mm) stem, 1-3/4 inch (44 mm) dial, external calibration.
   5. Bimetal thermometer, range 0 to 220 degrees F (-17 to 104 degrees C), 5 inch (127 mm) stem, 1-3/4 inch (44 mm) dial, external calibration.
   6. If extended “XL” plugs are used, provide the XL test kit which is suitable for any length of plug.

2.5 THERMOMETERS - DIAL

A. Manufacturers:
   1. Weiss.
   2. Trerice.
   3. Amtek.
   4. Ernst.

B. Thermometer: Weiss Model 45VA, ASTM E1, stainless steel or cast aluminum case, adjustable angle with front recalibration, vapor actuated, black scale on white-finished metal background, black pointer, sealed lens, brass stem.
   1. Size: 4 to 4-1/2 inch (101 to 114 mm) dial.
   2. Lens: Snap-in Lexan polycarbonate with o-ring, or clear glass with rubber ring.
   3. Bulb: Copper. Provide extended bulb for socket extension in insulated pipe.
   4. Extended Bulb: Where required, provide extended capillary tube with braided copper protection.
   5. Connection: Separable socket.

6. Accuracy: 1 scale division throughout range.
7. Calibration: Degrees F.
8. Scale Range: 30 to 240 degrees F (0 to 115 degrees C) for hot water heating, and supply air systems.
9. Graduations: 2 degrees F.
10. Air Duct Flange: Provide for duct applications.

2.6 THERMOMETER SUPPORTS

A. Socket (Thermometer Well) for Piping: Brass separable sockets for thermometer stems, with extensions for insulated piping. Provide with Honeywell viscous heat transfer paste.

B. Flange for Duct: 3 inch (76 mm) outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use ball valves for water service.

B. Use siphon for steam service.

C. Division 01 - Quality Requirements: Manufacturer's instructions.

D. Install one pressure gauge per pump, with taps on suction and discharge of pump; pipe to gauge.

E. Install gauge taps in piping; refer to Division 23 Section “Hydronic Piping”

F. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches (64 mm) for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

G. Fill thermometer sockets with heat transfer paste.

H. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets.

I. Locate duct mounted thermometers minimum 10 feet (3 m) downstream of mixing dampers, coils, or other devices causing air turbulence.

J. Coil and conceal excess capillary on remote element instruments.

K. Provide instruments with scale ranges selected according to service with largest appropriate scale.

L. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

M. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

N. Locate test plugs where indicated.

O. Provide pressure gauge at high point of system for setting of cold water make-up pressure reducing valve.

END OF SECTION 230519

SECTION 230529 – HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe and equipment hangers and supports.

B. Equipment bases and supports.

C. Sleeves and seals.

1.2 RELATED SECTIONS

A. Division 07 Section “Through-Penetration Firestop Systems”: Joint seals for piping and duct penetration of fire rated assemblies.

B. Division 23 Section “HVAC Piping Insulation.”

C. Division 23 Section “Hydronic Piping.”

1.3 REFERENCES

A. ASME B31.1 - Power Piping.

B. ASME B31.2 - Fuel Gas Piping.

C. ASME B31.5 - Refrigeration Piping.

D. ASME B31.9 - Building Services Piping.

E. ASTM A653 G90 SS Gr. 33 - Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot Dipped Process.

F. ASTM B633 B Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

G. ASTM C642 B Test Method for Specific Gravity, Absorption, and Voids in Hardened Concrete.

H. ASTM C672 B Test Methods for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.

I. ASTM D412 B Test Methods for Vulcanized Rubber and Thermoplastic Elastomers B Tension.

J. ASTM D395 B Standard Test Methods for Rubber Property B Compression Set.

K. ASTM D573 B Test Method for Rubber B Deterioration in an Air Oven.

L. ASTM D746 B Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.

M. ASTM D2240 B Test Method for Rubber Property B Durometer Hardness.

N. ASTM F708 - Design and Installation of Rigid Pipe Hangers.

O. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.

P. MSS SP69 - Pipe Hangers and Supports - Selection and Application.

Q. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

R. NFPA 13 - Installation of Sprinkler Systems.

S. NFPA 14 - Installation of Standpipe and Hose Systems.

T. NFPA 70 B National Electrical Code

U. UL 203 - Pipe Hanger Equipment for Fire Protection Service.

1.4 SUBMITTALS

A. Submit under provisions of Division 01 Section “Submittal Procedures”.

B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.

C. Product Data: Provide manufacturers catalog data including load capacity.

D. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

E. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable code for support of hydronic piping.

B. Supports for Electrical: In conformance with NFPA 70.

PART 2 - PRODUCTS

2.1 HANGERS, SUPPORTS, & PIPE CLAMPS

A. Approved Manufacturers (first manufacturer is basis of design):
   1. Strut Hangers:
      a. Unistrut (division of Tyco).
      b. Anvil International.
      c. Cooper B-Line.
      d. Hydra-Zorb Company.
      e. Thomas & Betts - Superstrut line.
      f. Tolco (division of Nibco).
   2. Adjustable Swivel Band Hangers:
      a. Carpenter & Paterson.
      b. Anvil International.
      c. Cooper B-Line.

d. Tolco (division of Nibco).

3. Clevis Hangers:
   a. Carpenter & Paterson.
   b. Anvil International.
   c. Cooper B-Line.
   d. Tolco (division of Nibco).
4. J-Hangers:
   a. Carpenter & Paterson.
   b. Cooper B-Line.
   c. Thomas & Betts - Superstrut line.
   d. Tolco (division of Nibco).
   e. Unistrut (division of Tyco).
5. Cushion Clamps:
   a. Hydra-Zorb Company.
   b. Cooper B-Line.
   c. Thomas & Betts - Superstrut line.
   d. Tolco (division of Nibco).
   e. Unistrut (division of Tyco).
6. Insulated Pipe Couplings:
   a. Klo-Shure Corporation.
   b. Cooper B-Line - Armafix line.
7. No substitutions.

B. Horizontal Piping Supports: Provide struts for trapeze hangers for single or multiple pipes. Where individual piping runs are hung with individual hangers, adjustable swivel band hangers, clevis hangers, or j-hangers may be used.

C. Strut hangers shall be standard 1-5/8”x1-5/8” size.

D. Pipe hanger rods and nuts shall be plated to match the hangers. Nuts shall be self-locking type, or provide double nuts tightened to lock together. Rods shall be threaded one end, or continuous threaded. Provide washers at each nut.

E. Cushion Clamps for Un-insulated Lines: Plastic cushion shall be Dupont Hytel plastic, 5555HS plastic elastomer, warranted from -40 F to 275 F.

F. Copper-plated hangers are plated for identification only. Traditional thin copper plating on steel substrate does not provide adequate protection from galvanic corrosion due to contact between dissimilar metals.
   1. Where copper-plated supports are specified for use with copper piping, either copper plating or a copper-colored finish such as Cooper B-Line’s Dura-Copper epoxy coating is acceptable. This is for identification, and does not protect dissimilar metals.

   2. Where copper piping is used with steel hangers and supports, provide protection from galvanic corrosion such as thick plastic or vinyl factory coating, or plastic-lined cushion clamps.

G. For Insulated Lines Clamped to Strut: Insulated pipe coupling insert with the same thickness as the insulation. Protects insulation from crushing, and provides continuous insulation and vapor barrier thru the hanger or clamp. Klo-Shure product provides plastic pipe support and rigid outer band, for

field insulation into the coupling. Armafix product provides insulation with rigid outer band, for field insulation glued to the ends of the insert.

2.2 PIPE SUPPORTS

A. Hydronic Piping:
   1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69 and MSS SP89.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Malleable iron, adjustable swivel, split ring.
   3. Hangers for Cold Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
   4. Hangers for Hot Pipe Sizes 2 to 4 Inches (50 to 100 mm): Carbon steel, adjustable, clevis.
   5. Hangers for Hot Pipe Sizes 5 Inches (125 mm) and Over: Adjustable steel yoke, cast iron roll, double hanger.
   6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches (150 mm) and Over: Steel channels with welded spacers and hanger rods, cast iron roll.
   8. Wall Support for Pipe Sizes to 3 Inches (76 mm): Cast iron hook.
   9. Wall Support for Cold Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.
   10. Wall Support for Hot Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
   11. Vertical Support: Steel riser clamp.
   12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   13. Floor Support for Hot Pipe Sizes to 4 Inches (100 mm): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   14. Floor Support for Hot Pipe Sizes 5 Inches (125 mm) and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
   15. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.3 INSERTS

A. Manufacturers:
   1. Grinnell.
   2. B-Line.

B. Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gauge (1.2 mm) thick galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gauge (1.2 mm) thick galvanized steel.

C. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

D. Sleeves for Round Ductwork: Galvanized steel.

E. Sleeves for Rectangular Ductwork: Galvanized steel.

F. Stuffing or Firestopping Insulation: Glass fiber type, non-combustible.

G. Sealant: Acrylic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.2 INSERTS

A. Provide inserts for placement in concrete formwork.

B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm).

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.3 PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as scheduled.

B. Install hangers to provide minimum 1/2 inch (13 mm) space between finished covering and adjacent work.

C. Place hangers within 12 inches (300 mm) of each horizontal elbow.

D. Use hangers with 1-1/2 inch (38 mm) minimum vertical adjustment.

E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet (1.5 m) maximum spacing between hangers.

F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

H. Support riser piping independently of connected horizontal piping.

I. Provide copper plated hangers and supports for copper piping.

J. Design hangers for pipe movement without disengagement of supported pipe.

K. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

L. Do not support pipes from other pipes or equipment.

M. Size pipe hangers to accommodate continuous piping insulation.

3.4 EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 4 inches (100 mm) thick and extending 6 inches (150 mm) beyond supported equipment, with 1-inch (25 mm) chamfered edges. Provide dowels to fasten pad to structural floor. Unless otherwise shown or specified, floor-mounted major equipment shall be set on housekeeping pads and anchored to housekeeping pads. This shall include but not be limited to CU-1 heat pump.

B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel members. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

E. Do not support equipment from pipes or from other equipment.

3.5 SLEEVES

A. Set sleeves in position in formwork. Provide reinforcing around sleeves.

B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

C. Extend sleeves through floors 1 inch (25 mm) above finished floor level. Caulk sleeves.

D. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with fire stopping insulation and caulk air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

E. Install chrome plated steel escutcheons at finished surfaces.

3.6 SCHEDULES

PIPE SIZE		HANGER ROD MAX. HANGER SPACING		DIAMETER	
Inches	(mm)	Feet	(m)	Inches	(mm)
Steel and Copper Piping					
1/2 to 1-1/4	12 to 32	6.5	2	3/8	9
1-1/2 to 2	38 to 50	10	3	3/8	9
2-1/2 to 3	62 to 75	10	3	1/2	13
4 to 6	100 to 150	10	3	5/8	15
8 to 12	200 to 300	14	4.25	7/8	22
14 and Over	350 and Over	20	6	1	25

END OF SECTION 230529

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SECTION 230553 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe Markers.

1.2 REFERENCES

A. Division 01 Section “References”: Requirements for references and standards.

B. ASME A13.1 - Scheme for the Identification of Piping Systems.

C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

1.3 SUBMITTALS

A. Division 01 Section “Submittal Procedures.”

B. Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Samples: Submit two tags, 1-1/2 inches (38 mm) in size.

F. Samples: Submit two labels, 1.9 x 0.75 inches (48 x 19 mm) in size.

1.4 PROJECT RECORD DOCUMENTS

A. Submit under Division 01 Section “Closeout Procedures.”

B. Record actual locations of tagged valves; include valve tag numbers.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 01 Section “Operation and Maintenance Data.”

B. Include valve tag chart.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Manufacturer: Seton Identification Products, a division of Tricor.

B. Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

C. Piping Systems: Labeled HVAC piping systems shall include but not be limited to the following:
1. LPS – Low Pressure Steam
2. LPC – Low Pressure Condensate
3. PC – Pumped Condensate
4. BFW – Boiler Feed-Water
5. FOS – Fuel Oil Supply
6. FOR – Fuel Oil Return
7. CF – Chemical Feed
8. GHWS – Glycol Hot Water Supply
9. GHWR – Glycol Hot Water Return

2.2 TAGS

A. Metal Tags:
1. Manufacturer: Seton Identification Products, a division of Tricor.
2. Brass with stamped letters; tag size minimum 1-1/2 inches (38 mm) diameter with smooth edges.

B. Information Tags:
1. Manufacturer: Seton Identification Products, a division of Tricor.
2. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches (83 x 143 mm) with grommet and self-locking nylon ties.

C. Tag Chart: Typewritten letter size list in anodized aluminum frame with plexiglass cover.

2.3 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1.

B. Plastic Pipe Markers:
1. Manufacturer: Seton Identification Products, a division of Tricor.
2. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

2.4 LABELS

A. Manufacturer: Seton Identification Products, a division of Tricor.

B. Description: Polyester, size 1.9 x 0.75 inches (48 x 19 mm), adhesive backed with printed identification.

2.5 LOCKOUT DEVICES

A. Lockout Hasps:
   1. Manufacturer: Seton Identification Products, a division of Tricor.
   2. Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches (184 x 76 mm).

B. Valve Lockout Devices:
   1. Manufacturer: Seton Identification Products, a division of Tricor.
   2. Nylon device preventing access to valve operator, accepting lock shackle.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Division 01 Section “Quality Requirements”: Manufacturer's instructions.

B. Install identifying devices after completion of coverings and painting.

C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

D. Install labels with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

E. Install tags using corrosion resistant chain. Number tags consecutively by location.

F. Identify items of mechanical equipment such as air handling units, pumps and heat transfer equipment with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.

G. Identify control panels and major control components outside panels with plastic nameplates.

H. Identify valves in main and branch piping with metal tags.

I. Tag automatic controls, instruments, and relays. Key to control schematic.

J. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch (20 mm) diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m)on straight runs including risers and drops, at each branch and riser take-off, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

K. Identify duct access doors at fire dampers, smoke dampers, and smoke detectors with 1/2-inch (12.7 mm) lettering to indicate the fire protection device(s) within, in accordance with NFPA 90A.

L. Provide ceiling tacks to locate valves, dampers and equipment above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

M. Secure valve tag chart on an easily accessible wall in the mechanical room or in a location as otherwise directed by the Architect.

3.3 COORDINATION WITH EXISTING EQUIPMENT

A. Where an existing equipment identification system is involved, the new system shall be coordinated and compatible with the existing system.

END OF SECTION 230553

SECTION 230713 – DUCT INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Ductwork Insulation.

1.2 SUBMITTALS

A. Division 01 Section “Submittal Procedures”.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this Section with minimum 3 years’ experience.

B. Applicator Qualifications: Company specializing in performing the work of this Section with minimum 3 years’ experience.

1.4 REGULATORY REQUIREMENTS

A. Materials: Flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255 and UL 723. For elastomeric foam insulation, rating shall apply for thicknesses up to 2 inches.

B. Insulation materials shall be asbestos free. No fibers with dimensions similar to asbestos fibers shall be released from any material.

1.5 DELIVERY, STORAGE, AND PROTECTION

A. Division 01 Section “Product Requirements”: Transport, handle, store, and protect products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Division 01 Section “Product Requirements”: Environmental conditions affecting products on site.

B. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

C. Maintain temperature during and after installation for minimum period of 24 hours.

1.7 EXISTING DUCTWORK

A. Existing exhaust duct risers within existing chases are not required to be insulated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Glass and Mineral Fiber Products:
   1. Knauf Insulation.
   2. Certainteed Corporation.
   3. Johns Manville.
   4. Owens Corning.
   5. No substitutions.

B. Glass Fiber Insulation Sealing Tapes:
   1. Venture Tape Corporation.
   2. 3M Company.
   3. Ideal Tape Co., division of American Biltrite Inc.
   4. Nashua Tape Products, division of Berry Plastics Corp.
   5. No substitutions.

C. Accessories:
   1. Ceel-Co division of Johns Manville (product: plastic jacket systems).
   2. Foster Products, division of Specialty Construction Brands, Inc., a subsidiary of H.B. Fuller (mastics, sealants, reinforcing membranes, and accessories).
   3. Johns Manville (products: Super-Seal acrylic polymer coatings, Zeston plastic jacket systems).
   4. Pabco/Childers Metals, division of ITW Insulation Systems (products: metal jacket systems, and accessories).
   5. Vac Systems International (product: Tough Coat acrylic polymer mechanical insulation repair coating).
   6. Venture Tape Corporation (product: Jacket for outdoor insulation).

2.2 GLASS FIBER, FLEXIBLE

A. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. 'K' ('Ksi') value: ASTM C518, 0.27 at 75ºF.
   2. Maximum service temperature: 250ºF faced and 350ºF unfaced.
   3. Maximum moisture absorption: 0.20 percent by volume.
   4. Minimum density: 1.0 lb/cu.ft.

B. Vapor Barrier Jacket:
   1. ASTM C1136, Kraft paper reinforced with glass fiber yarn and bonded to vapor barrier film. Facing as required for the application. Integral staple flap on one edge.
      a. Aluminum Faced: FSK (aluminum foil-scrim-kraft) construction.
      b. White Faced: PSK (polypropylene-scrim-kraft) construction.

2. Moisture vapor transmission: ASTM E96; 0.02 perm.
3. Suitable for insulation surface temperatures up to 150°F.
4. Overlap longitudinal laps and butt strips.
5. Secure with outward clinch expanding staples and vapor barrier mastic and pressure sensitive tape.

C. Vapor Barrier Tape: See article "Glass Fiber Insulation Sealing Tape" in this Section.

D. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

E. Tie Wire: Annealed steel, 16 gage.

2.3 GLASS FIBER, RIGID

A. Insulation: ASTM C612; rigid, noncombustible blanket. Supplied in board form.
1. 'K' ('Ksi') value: ASTM C518, 0.24 at 75ºF.
2. Maximum service temperature: 450ºF.
3. Maximum moisture absorption: 1.0 percent by volume.
4. Density: 3.0 lb/cu ft.

B. Vapor Barrier Jacket:
1. ASTM C1136, kraft paper reinforced with glass fiber yarn and bonded to aluminized film. Facing as required for the application.
   a. Aluminum Faced: FSK (foil-scrim-kraft) construction
   b. White Faced: ASJ (all-service jacket) construction.
2. Moisture vapor transmission: ASTM E96; 0.02 perm.
3. Suitable for insulation surface temperatures up to 150°F.
4. Overlap longitudinal laps and butt strips.
5. Secure insulation with mechanical fasteners to substrate, and seal jacket with pressure sensitive tape.

C. Vapor Barrier Tape: See article "Glass Fiber Insulation Sealing Tape" in this Section.

D. Indoor Vapor Barrier Finish:
1. Cloth: Untreated; 9 oz/sq yd weight, glass fabric.
2. Vinyl emulsion type acrylic, compatible with insulation, white color.

2.4 GLASS FIBER, SEMI-RIGID

A. Insulation: ASTM C612; semi-rigid, noncombustible blanket, with fibers oriented perpendicular to insulation surface to provide compressive strength while maintaining flexibility. Supplied in roll form, suitable for application on rounded shapes such as pipes, tanks, ducts, vessels, and other similar round and irregular shapes.
1. 'K' ('Ksi') value: ASTM C518, 0.24 at 75ºF.
2. Maximum service temperature: 450ºF.
3. Maximum moisture absorption: 1.0 percent by volume.
4. Density: 2.5 lb/cu ft.

B. Vapor Barrier Jacket:

1. ASTM C1136, kraft paper with glass fiber yarn and bonded to aluminized film. Facing as required for the application.
    a. Aluminum Faced: FSK (foil-scrim-kraft) construction
    b. White Faced: ASJ (all-service jacket) construction.
2. Moisture vapor transmission: ASTM E96; 0.02 perm.
3. Suitable for insulation surface temperatures up to 150°F.
4. Overlap longitudinal laps and butt strips.
5. Secure with outward clinch expanding staples and vapor barrier mastic and pressure sensitive tape.

C. Vapor Barrier Tape: See article "Glass Fiber Insulation Sealing Tape" in this Section.

D. Indoor Vapor Barrier Finish:
1. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight, glass fabric.
2. Vinyl emulsion type acrylic, compatible with insulation, white color.

2.5 GLASS FIBER INSULATION SEALING TAPE

A. Self-adhesive tape with integral vapor barrier, pressure sensitive acrylic-based or rubber-based adhesive, and release liner strip. Width 3 in. nominal.

B. Manufactured by VentureTape, by the insulation manufacturer, or by one of the other tape manufacturers listed in the article "Manufacturers" in this Section.

C. Types:
1. For rigid and semi-rigid insulations, tape shall be reinforced type. For flexible "duct wrap" insulation, tape shall be either reinforced or non-reinforced.
2. White or aluminum outer surface to match the insulation.
3. Reinforced: Kraft paper reinforced with glass fiber yarn and bonded to vapor barrier layer.
    a. Aluminum Finish with FSK: VentureTape 1525CW.
    b. White Finish with ASJ: VentureTape 1540CW
    c. White Finish with PSK: VentureTape 1531CW.
4. Non-Reinforced: Foil insulation tape. Dead-soft temper 2 mil thick aluminum foil, without reinforcement. Hand-tearable.
    a. Venture Tape 3520CW.
5. Performance:
    a. Peel Adhesion: PSTC-101 with 20 minute dwell, 45 oz/in..
    b. Shear Adhesion: PSTC-107, 2.2 psi after 24 hours.
    c. Tensile Strength: PSTC-131:
        1) Reinforced Types: 40 lb/in.
        2) Non-reinforced Types: 21 lb/in.
    d. Elongation: PSTC 131, 6 percent maximum.
    e. Service Temperature: -40 to 240°F.
    f. UL 723 listed or classified (flame/smoke rating).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 Section “Project Management and Coordination”: Verification of existing conditions before starting work.

B. Verify that ductwork has been tested before applying insulation materials.

C. Verify that surfaces are clean, foreign material removed, and dry.

D. Verify that insulation materials are clean and dry. Discard any materials that exhibit signs of moisture damage, contamination, mold, mildew, or other biological growth. Discard any materials used in the air handling airstream if they have been exposed to water.

3.2 INSTALLATION

A. Division 01 Section “Quality Requirements”: Manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. In addition to new ductwork, provide insulation for surfaces of existing ductwork that is not insulated. Field-verify scope of existing ductwork.

D. Provide insulation for surfaces of ductwork, as indicated and specified. Insulation values shall meet or exceed the requirements of ASHRAE 90.1-2010, State Energy Codes, and Table I, whichever is greater. In addition, comply with the other requirements of this Section.

E. Insulated Ductwork Conveying Air below Ambient Temperature:
1. Provide insulation with vapor barrier jackets.
2. Finish with tape and vapor barrier jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

F. Insulated Ductwork Conveying Air above Ambient Temperature:
1. Provide with or without standard vapor barrier jacket.
2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

G. Where rigid glass fiber insulation is scheduled, semi-rigid glass fiber insulation may be used on round and flat oval ducts and irregular shapes, and preformed pipe insulation may be used on small diameter round ducts.

H. External Duct Insulation Application:
1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
2. Secure insulation without vapor barrier with staples, tape, or wires.
3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

I. Inspection Plates and Test Holes: Provide, where required, in ductwork or casings for balance measurements. Test holes shall be factory fabricated, airtight, and noncorrosive with screw cap and gasket. Extend cap through insulation.

J. Install insulation after ductwork and equipment have been tested and approved.

K. Ensure that surface is clean and dry prior to installation. Ensure that insulation is dry before and during application. Finish with system at operating conditions.

L. Ensure that insulation is continuous through inside walls. Pack around ducts with fireproof self-supporting insulation material, properly sealed.

M. Finish insulation neatly at hangers, supports and other protrusions.

N. Locate insulation or cover seams in least visible locations.

O. Repair separation of joints or cracking of insulation due to thermal movement or poor workmanship.

P. Do not insulate exposed ductwork in conditioned spaces or ductwork that is acoustically lined, unless otherwise specified or indicated on the Drawings.

Q. Wherever exposed ductwork for air conditioned systems passes through non air conditioned spaces, insulate ductwork with glass fiber rigid insulation with vapor barrier, to prevent condensation.

R. Standing seams, supporting angles and flanges on insulated ductwork shall be insulated with thickness equal to the duct and edges shall be finished and vapor sealed.

S. Mechanical fasteners shall not be riveted or screwed to the duct and shall not penetrate the metalwork.

T. For supply or return ductwork which is required to be insulated, insulation shall be continuous and shall include the insulating of register, grille and diffuser connection plenums/boots.

3.3 FIELD INSPECTION

A. Visually inspect to ensure that materials used conform to Specifications. Inspect installations progressively for compliance with requirements.

TABLE I
DUCTWORK INSULATION MATERIAL AND WALL THICKNESS

DUCTWORK TYPE	INSULATION MATERIAL	VAPOR BARRIER REQUIRED	INSULATION WALL THICKNESS
Outside air intake ductwork to Heating/Ventilating Units and Supply/Exhaust ductwork to within 10’ from roof.	Glass Fiber, Flexible (only if ductwork is concealed)	Yes	1 1/2"
	Glass Fiber, Rigid	Yes	1"

END OF SECTION 230713

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SECTION 230719 – HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

C. Shields, Inserts, and Saddles.

1.2 SUBMITTALS

A. Submit under provisions of Division 01 Section “Submittal Procedures”.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this Section with minimum 3 years’ experience.

B. Applicator Qualifications: Company specializing in performing the work of this Section with minimum 3 years’ experience.

1.4 REGULATORY REQUIREMENTS

A. Conform to maximum flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255 and UL 723. For elastomeric foam insulation, rating shall apply for thicknesses up to 2 inches.

B. Insulation materials and accessories shall be asbestos-free. No fibers with dimensions similar to asbestos fibers shall be released from any material.

1.5 DELIVERY, STORAGE, AND PROTECTION

A. Division 01 Section “Product Requirements”: Transport, handle, store, and protect products.

B. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Division 01 Section “Product Requirements”: Environmental conditions affecting products on site.

B. Maintain ambient conditions required by manufacturers of each product.

C. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Cellular Glass Products:
   1. Pittsburgh Corning USA. Foamglas product line.
   2. No substitutions.

B. Elastomeric Foam Products:
   1. Armacell LLC.
   2. K-Flex USA.
   3. No substitutions.

C. Glass and Mineral Fiber Products:
   1. Knauf Insulation.
   2. Certainteed Corporation.
   3. Johns Manville.
   4. Owens Corning.
   5. No substitutions.

D. Accessories:
   1. Ceel-Co division of Johns Manville (product: plastic jacket systems).
   2. Foster Products, division of Specialty Construction Brands, Inc., a subsidiary of H.B. Fuller (mastics, sealants, reinforcing membranes, and accessories).
   3. Johns Manville (products: Super-Seal acrylic polymer coatings, Zeston plastic jacket systems).
   4. Pabco/Childers Metals, division of ITW Insulation Systems (products: metal jacket systems, and accessories).
   5. Pittsburgh Corning (product: cellular glass insulation for high-density inserts).
   6. Proto Corporation (product: plastic jacket systems).
   7. Vac Systems International (product: Tough Coat acrylic polymer mechanical insulation repair coating).

2.2 CELLULAR GLASS

A. Insulation: ASTM C552 and ASTM 1639; soda-lime silicate glass foam, noncombustible. Formed from sintered powdered glass and carbon black, heated in a “cellulation” process which creates carbon dioxide gas, which forms the bubbles and is permanently trapped in the cells. No “blowing agents” are used in its manufacturing.
   1. 'K' (KSI) Value: ASTM C177 or ASTM C518, 0.29 at 75 degrees F (0.042 at 24 degrees C).
   2. Maximum Service Temperature: 900 degrees F (482 degrees C).
   3. Maximum Moisture Absorption: ASTM C240, 0.2 percent by volume.
   4. Water Vapor Permeability: ASTM E96 Wet Cup Procedure B, 0.00 perm-in. (0.00 perm-cm).
   5. Flexural Strength, Block: ASTM C203 or C240, 70 psi (480 kPa).
   6. Density: 7.5 lb/cu ft (12024 kg/cu m).

B. Accessories:
   1. Coatings: Pittcote 300 Finish, and Pittcote 404 Coating.
   2. Fabric: PC Fabric 79.
   3. Sealant: Pittseal 444N, Pittseal CW, and RTV 450 Silicone Adhesive.
   4. Adhesive: PC 88.

5. Jacketing: Pittwrap, Pittwrap SS, Pittwrap CW Plus, Pittwrap CW30, and Pittwrap IW 50.

2.3 GLASS FIBER

A. Insulation: ASTM C547; rigid molded, noncombustible.
   1. 'K' ('Ksi') value: ASTM C177, 0.24 Btu-in/(hr-sq.ft-°F) at 75°F.
   2. Maximum service temperature: 850°F.
   3. Maximum moisture absorption: 0.2 percent by volume.

B. Vapor Barrier Jacket:
   1. ASTM C1136, White kraft paper with glass fiber yarn, bonded to aluminized film.
   2. Moisture vapor transmission: ASTM E96; 0.02 perm-inches.

C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

D. Vapor Barrier Lap Adhesive: Compatible with insulation.

E. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

F. Indoor Vapor Barrier Finish:
   1. Cloth: Untreated; 9 oz/sq yd weight.
   2. Vinyl emulsion type acrylic, compatible with insulation, white color.

G. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

H. Outdoor Breather Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

I. Insulating Cement: ASTM C449/C449M.

2.4 ELASTOMERIC FOAM

A. Products:
   1. Armacell: AP Armaflex and AP Armaflex FS pipe and sheet insulation.
   2. K-Flex USA: Insul-Tube and K-Flex LS pipe insulation, and Insul-Sheet S2S and K-Flex LS sheet insulation.
   3. No substitutions.

B. Insulation: ASTM C534; flexible, cellular elastomeric, molded or sheet.
   1. 'K' ('Ksi') value: ASTM C177; 0.277 Btu-in/(hr-sq.ft- degrees F) at 75 degrees F (0.04 W/m-K at 24 degrees C).
   2. Minimum service temperature: -70 degrees F (-57 degrees C) (flexible to -20 degrees F (-29 degrees C)).
   3. Maximum service temperature: 220 degrees F (104 degrees C).
   4. Maximum moisture absorption: ASTM C209, 0.2 percent by volume; or ASTM D1056, 5 percent by weight.
   5. Moisture vapor transmission: ASTM E96; 0.08 perm-inches (0.116 ng/(s-m-Pa)).
   6. Connection: Waterproof vapor barrier adhesive.

C. White Insulation for Exposed Locations: Where exposed to the occupants' view, provide

insulation in white or off-white color, Armacell's AP/Armaflex W or K-Flex USA's Insul-Tube White and Insul-Sheet White.

D. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

E. Insulated Hanger Inserts: At Contractor's option, Armacell Armafix IPH insulated pipe hanger inserts may be used at hanger locations.
   1. Engineered from Armaflex insulation, with inserts of CFC-free PPUR/PIR polyurethane foam insulation bearing segments.
   2. Outer shell of 30 mils (0.76 mm) -thick painted aluminum.
   3. Self-adhesive closure strip.

F. Provide Armaflex insulation tape, wrapped around the IPH prior to placing in the hanger.

2.5 FIELD-APPLIED JACKETS

A. Aluminum Jacket: ASTM B209, ASTM B209M.
   1. Thickness: 0.016 inch sheet.
   2. Finish: Corrugated.
   3. Joining: Longitudinal slip joints and 2 inch laps.
   4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.
   6. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

2.6 SHIELDS, INSERTS, AND SADDLES

A. Shields:
   1. Carpenter and Paterson Figure 265GS, or equal.
   2. Galvanized or electro-galvanized steel, minimum 12 inch length, minimum 120-degree arc, minimum 18 gauge.
   3. Provide contact adhesive to glue shields to the insulation.

B. Snap-On Shields:
   1. Cooper B-Line "Snap'N Shield".
   2. Snap-N Shield is an acceptable substitute for metal shields when installed with strut trapeze hangers on horizontal piping.
   3. Paintable polypropylene plastic 12-inch long preformed shields, snap-on design for attachment to strut.
   4. Gluing is not required with Snap-N Shield.
   5. Provide black or white color to match the insulation in areas exposed to public view.

C. Inserts:
   1. Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   2. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

D. Saddles:
   1. Factory fabricated of curved carbon steel plate, of same overall thickness and contour as adjoining insulation. Sides designed for welding to pipe. Center support plate for pipe sizes 12 inches and larger.

2.7 MANUFACTURER'S STAMP OR LABEL

A. Every package or standard container of insulation, jackets, cements, adhesives, and coatings delivered to the project site for use shall have the manufacturer's stamp or label attached giving name of manufacturer, brand, and description of material. Insulation packages and containers shall be asbestos-free.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Division 01 Section "Quality Requirements": Manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards where applicable.

C. Provide insulation for surfaces of new piping and for surfaces of existing piping that is uninsulated, as indicated and specified.

D. Insulation values shall meet or exceed the requirements of ASHRAE 90.1-2010, applicable State Energy Codes, and Table I, whichever is greater. In addition, comply with the other requirements of this Section.
   1. International Energy Conservation Code (IECC): Chapter 5 of the Code allows the use of ASHRAE 90.1 insulation thicknesses instead of the Minimum Pipe Insulation table which is in Chapter 5 of the IECC. This Specification does not reference the table in IECC.

E. Piping systems requiring insulation, types of insulation required, and insulation thickness shall be as listed in Table I herein. For piping not listed in Table 1, insulate to meet Code requirements, using suitable specified materials, subject to Architect's approval. Except for flexible unicellular insulation, insulation thicknesses as specified in Table I shall be one inch greater for insulated piping systems located outside the building and in unconditioned spaces. Unless otherwise specified, insulate fittings, flanges, and valves, except valve stems, hand wheels, and operators. Use factory pre-molded, precut, or field-fabricated insulation of the same thickness and conductivity as used on adjacent piping. Insulation exterior shall be factory cleanable, grease resistant, non-flaking, and non-peeling.

F. Exposed Piping: Locate insulation and cover seams in least visible locations.

G. Insulated Pipes Conveying Fluids Below Ambient Temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

H. Glass Fiber Insulated Pipes Conveying Fluids below Ambient Temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.

2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

I. For hot piping conveying fluids 140ºF or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

J. For hot piping conveying fluids over 140ºF, insulate flanges and unions at equipment.

K. Glass Fiber Insulated Pipes Conveying Fluids above Ambient Temperature:
1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

L. For piping which may operate at a range of temperatures (for example, heat recovery and heat exchange piping), provide insulation and vapor barriers as are suitable for the entire range of operation.

M. Large Valve Bodies and Other Fittings: Large valves and other fittings requiring service access may be insulated with removable, reusable equipment covers with "Velcro" closures.

N. Branches to Expansion Tanks: For chilled water systems, insulate completely. For hot water systems, insulate from the connection at the main to at least 10 feet toward the tank.

O. Branches to Gauges, Sensors, Drains, and Vents: Insulate branches to gauges, sensors, drains, and vents as for active sections of piping. For piping with operating temperatures above ambient, insulate to at least 6 inches from the active main. For temperature devices, insulate to include the sensing bulb or other element. For pressure devices in hot piping with syphon loops, insulate from the active main to the syphon loop, but it is not necessary to insulate the syphon loop or the portion of the branch on the device side of the syphon loop.

P. Shields, Inserts, and Saddles:
1. Application: Provide shields at hangers. Provide inserts for piping 2 in. nominal size or larger.
2. Shield location: Between insulation jacket and hanger.
3. Insert location: Between support shield and piping and under the finish jacket.
4. Saddle location: Between support shield and piping.

5. Glue shields to outside of insulation after system is filled and run at operating temperature.
6. Align mid-length of shields, inserts, and saddles with the hanger centerline.

Q. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.

R. Pipe Exposed in Mechanical Equipment Rooms 10 feet or Less Above Finished Floor:
1. Piping Which Crosses Walking and Service Access Paths 4 feet or Less Above Finished Floor: Finish with aluminum jacket and fitting covers.
2. Other Piping: Finish with aluminum jacket and fitting covers.

S. Exterior Applications:

1. Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass-mesh-reinforced vapor barrier cement.
2. Hot Water and Steam Piping: Cover with aluminum jacket and fitting covers with seams located on bottom side of horizontal piping.
3. Other Piping: Cover with aluminum jacket and fitting covers with seams located on bottom side of horizontal piping.

T. Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil (0.025 mm) thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

3.3 UNIFORM INSTALLATION

A. Systems shall use a single insulation type throughout the installation.

3.4 PREPARATION

A. Insulate piping after system tests have been completed and surfaces to be insulated have been cleaned of dirt, rust, and scale and dried. Ensure full range of motion of equipment actuators. Modify insulation to avoid obstruction of valve handles, safety reliefs, and other components requiring movement. Allow adequate space for pipe expansion. Install insulation with jackets drawn tight and cement down on longitudinal and end laps. Do not use scrap pieces where a full length section will fit. Insulation shall be continuous through sleeves, wall and ceiling openings. Extend surface finishes to protect surfaces, ends, and raw edges of insulation. Apply coatings and adhesives at the manufacturer’s recommended coverage per gallon. Individually insulate piping. Provide a moisture and vapor seal where insulation terminates against metal hangers, anchors and other projections through the insulation on surfaces for which a vapor seal is specified. Keep insulation dry during the application of any finish. Bevel and seal the edges of exposed insulation. Unless otherwise indicated, do not insulate the following:
1. Piping in radiation enclosures, or within cabinets of unit heaters.
2. Valve hand wheels.
3. Fire protection pipes. Vibration isolating connections.
4. Adjacent insulation.
5. ASME stamps.

3.5 PIPING INSULATION

A. Pipe Insulation (Except Elastomeric Insulation): Place sections of insulation around the pipe and joints tightly butted into place. The jacket laps shall be drawn tight and smooth. Secure jacket with fire resistant adhesive, factory applied self-sealing lap. Cover circumferential joints with butt strips, not less than 3-inches wide, of material identical to the jacket material. Overlap longitudinal laps of jacket material not less than 1-1/2 inches. Adhesive used to secure the butt strip shall be the same as used to secure the jacket laps. When a vapor barrier jacket is required, as indicated in Table I, or on the ends of sections of insulation that butt against flanges, unions, valves, fittings, and joints, use a vapor-barrier coating conforming to manufacturer's weatherproof coating for outside service. Apply this vapor barrier coating at longitudinal and circumferential laps. Patch damaged jacket material by wrapping a strip of jacket material around the pipe and cementing, and coating as specified for butt strips. Extend the patch not less than l-l/2 inches past the break in both directions. At penetrations by pressure gauges and thermometers, fill the voids with the vapor barrier coating for outside

service. Seal with a brush coat of the same coating. Where penetrating roofs, insulate piping to a point flush with the top of the flashing and seal with the vapor barrier coating. Butt tightly the exterior insulation to the top of the flashing and interior insulation. Extend the exterior metal jacket 2 inches down beyond the end of the insulation. Seal the flashing and counterflashing underneath with the vapor barrier coating.

B. Sleeves and Wall Chases: Where penetrating interior walls, extend a metal jacket 2 inches out on either side of the wall and secure on each end with a band. Where penetrating floors, extend a metal jacket from a point below the back-up material to a point 10 inches above the floor with one band at the floor and one not more than one inch from end of metal jacket. Where penetrating exterior walls, extend the metal jackets through the sleeve to a point 2 inches beyond the interior surface of the wall.

C. Elastomeric Foam Insulation: Bond cuts, butt joints, ends, and longitudinal joints with adhesive. Miter 90-degree turns and elbows, tees, and valve insulation. Where pipes penetrate fire walls, provide mineral-fiber insulation inserts and sheetmetal sleeves. Insulate flanges, unions, valves, and fittings in accordance with manufacturer's published instructions. Apply two coats of vinyl lacquer finish to elastomeric foam insulation before applying PVC jacket in outside locations.

3.6 FIELD INSPECTION

A. Visually inspect to ensure that materials used conform to specifications. Inspect installations progressively for compliance with requirements.

TABLE I
PIPING INSULATION MATERIAL AND WALL THICKNESS

SERVICE	INSULATION MATERIAL	VAPOR BARRIER REQUIRED	INSULATION WALL THICKNESS AT THE FOLLOWING PIPE DIAMETERS				
			<1 inch	1 inch to <1.5 inches	1.5 inches to <4 inches	4 inches to <8 inches	8 inches or Greater
Heating Systems (Steam, Steam Condensate, Hot Water Supply and Return)							
Fluid Design Operating Temperature Range							
251 degrees F to 350 deg. F	Glass Fiber	No	3 inches	4 inches	5 inches	5 inches	5 inches
201 degrees F to 250 deg. F	Glass Fiber	No	2.5 inches	2.5 inches	2.5 inches	3 inches	3 inches
141 degrees F to 200 deg. F	Glass Fiber	No	1.5 inches	1.5 inches	2 inches	2 inches	2 inches
105 degrees F							

SERVICE	INSULATION MATERIAL	VAPOR BARRIER REQUIRED	INSULATION WALL THICKNESS AT THE FOLLOWING PIPE DIAMETERS				
			<1 inch	1 inch to <1.5 inches	1.5 inches to <4 inches	4 inches to <8 inches	8 inches or Greater
to 140 deg. F	Glass Fiber	Yes	1 inch	1 inch	1.5 inches	1.5 inches	1.5 inches
Air Conditioning Condensate Drain Located Inside Building	Elastomeric Foam	N/A	0.75 inches	0.75 inches	1 inch	1.5 inches	1.5 inches
	Glass Fiber	Yes	0.75 inches	0.75 inches	1 inch	1.5 inches	1.5 inches
Refrigerant Suction [and Liquid] Piping							
Operating Temperature							
40 degrees F to 60 deg. F	Elastomeric Foam	N/A	0.75 inch	1 inch	1 inch	1.5 inches	2 inches
Below 40 degrees F	Elastomeric Foam	N/A	1 inch	1 inch	1 inch	1.5 inches	2 inches

END OF SECTION 230719

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SECTION 230900 - INSTRUMENTATION AND CONTROL FOR MECHANICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes control equipment for HVAC and Plumbing systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

1.3 DEFINITIONS

A. Note: The terms ATC, BAS, and DDC may be used interchangeably in this Section and on the Drawings, to indicate the overall control system.

B. Definitions:
1. ATC: Automatic temperature control.
2. BACnet: A control network technology platform for designing and implementing interoperable control devices and networks.
3. BAS: Building Automation System.
4. DDC: Direct digital control.
5. I/O: Input/output.
6. MS/TP: Master slave/token passing.
7. PC: Personal computer.
8. PID: Proportional plus integral plus derivative.
9. RTD: Resistance temperature detector.

1.4 SYSTEM PERFORMANCE

A. Comply with the following performance requirements:
1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.
5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
6. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.
7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.

8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
    a. Water Temperature: Plus or minus 1 deg F (0.5 deg C).
    b. Water Flow: Plus or minus 5 percent of full scale.
    c. Water Pressure: Plus or minus 2 percent of full scale.
    d. Space Temperature: Plus or minus 1 deg F (0.5 deg C).
    e. Ducted Air Temperature: Plus or minus 1 deg F (0.5 deg C).
    f. Outside Air Temperature: Plus or minus 2 deg F (1.0 deg C).
    g. Temperature Differential: Plus or minus 0.25 deg F (0.15 deg C).
    h. Pressure Differential: Plus or minus 1 percent of full scale.
    i. Air Pressure (Ducts): Plus or minus 0.1-inch wg (25 Pa).
    j. Electrical: Plus or minus 5 percent of reading.

1.5 SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
    1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
    2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
    3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
    1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
    2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
    3. Wiring Diagrams: Power, signal, and control wiring.
    4. Details of control panel faces, including controls, instruments, and labeling.
    5. Written description of sequence of operation.
    6. Schedule of dampers including size, leakage, and flow characteristics.
    7. Schedule of valves including size and flow characteristics.
    8. DDC System Hardware:
        a. Wiring diagrams for control units with termination numbers.
        b. Schematic diagrams and floor plans for field sensors and control hardware.
        c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
    9. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
    10. Controlled Systems:
        a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.

b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
c. Written description of sequence of operation including schematic diagram.
d. Points list.

C. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE Standard 135 (BACNET).

D. Software and Firmware Operational Documentation: Include the following:
1. Software operating and upgrade manuals.
2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.
5. Software license required by and installed for DDC workstations and control systems.

E. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.

F. Qualification Data: For Installer and manufacturer.

G. Field quality-control test reports.

H. Operation and Maintenance Data: For mechanical instrumentation and control system to include in emergency, operation, and maintenance manuals. Include the following:
1. Maintenance instructions and lists of spare parts for each type of control device.
2. Interconnection wiring diagrams with identified and numbered system components and devices.
3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
5. Calibration records and list of set points.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with ASHRAE Standard 135 (BACnet) for DDC system components.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, provide shipping of control devices to equipment manufacturer, in a timely manner coordinated with the equipment manufacturer.

B. Components to be Installed Under Other Sections: For components to be installed under other Sections of the Specifications, provide delivery of components to appropriate Subcontractors, provide installation instructions, and supervise their installation.

C. System Software: Update to latest version of software at Project completion.

1.8 COORDINATION

A. Coordinate location of thermostats and other exposed control sensors with plans and room details before installation.

B. Coordinate equipment with Division 26 Section "Fire Alarm Systems" to achieve compatibility with equipment that interfaces with that system.

C. Coordinate equipment with Division 26 Section "Panelboards" to achieve compatibility with starter coils and annunciation devices.

D. Coordinate line-voltage power supplies with Division 26.

1.9 EXTRA MATERIALS

A. (Not Used.)

PART 2 - PRODUCTS

2.1 ACCEPTABLE SUPPLIERS

A. Acceptable Manufacturers and Installers:
1. Basis of Design: Delta, installed by IB Controls, 3 Pope Road, Windham, ME 04062
2. No other substitutions will be permitted.

B. System components shall generally be the products of a single manufacturer(s) listed above. Where manufacturers are listed in paragraphs below, those lists shall apply to their specific products only. Miscellaneous components which the control system manufacturer doesn't manufacture such as cabling, conduits, transformers, and ice cube relays may be products of other manufacturers, subject to approval.

C. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in a multi-user, multitasking environment on a token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

2.2 UNACCEPTABLE BIDDERS

A. Bids by wholesalers, contractors or franchised dealers or any other firm whose principal business is not that of manufacturing or installing automatic temperature control systems or of those not listed above shall not be acceptable. Bid documents that are not complete in their

response to these documents or take exception to any of the capabilities defined within these documents will be rejected.

2.3 DDC EQUIPMENT

A. Operator Workstation: Communicate back to existing operator workstation.

B. Application Software:
1. Existing operating system shall be upgraded to latest control system.
2. I/O capability from operator station.
3. System security for each operator via software password and access levels.
4. Automatic system diagnostics; monitor system and report failures.
5. Database creation and support.
6. Automatic and manual database save and restore.
7. Dynamic color graphic displays.
8. Custom graphics generation and graphics library of Mechanical equipment and symbols.
9. Alarm processing, messages, and reactions.
10. Trend logs retrievable in spreadsheets and database programs.
11. Alarm and event processing.
12. Object and property status and control.
13. Automatic restart of field equipment on restoration of power.
14. Data collection, reports, and logs. Include standard reports for the following:
    a. Current values of objects.
    b. Current alarm summary.
    c. Disabled objects.
    d. Alarm lockout objects.
    e. Logs.
15. Custom report development.
16. Utility and weather reports.
17. Workstation application editors for controllers and schedules.
18. Maintenance management.

C. 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, antishort cycling, PID control, DDC with fine tuning, and trend logging.

b. Mechanical Control Programs: Optimal run time, supply-air reset, and enthalpy switchover.
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.
f. Units of Measure: Inch-pound and SI (metric).

4. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
5. ASHRAE 135 (BACnet) Compliance: Control units shall use BACnet 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 with three-position (on-off-auto) override switches and status lights.
5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA).
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. Any temperature control panels required in addition to those indicated on the Drawings shall be powered by the ATC Subcontractor.

F. Wall mounted thermostats and temperature sensors shall be attached either to a wall stud or to blocking, or to an electrical wall box attached to such wall framing. Attaching to gypsum wallboard only shall not be allowed.

G. Outdoor air temperature sensor(s) shall be installed on the North side of the building.
1. Thermostats and temperature sensors are shown on the drawings for general location. Terminal heat transfer units and fans which control space temperature shall be provided with thermostatic control, whether or not a thermostat or temperature sensor has been shown on the drawings

H. 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-microsecond 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.

I. 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.

2.4 SPARE POINTS

A. Provide a minimum of 10 percent spare points or 16 spare points, whichever is greater, in each ATC control panel for future use. Spare points shall be equally distributed among analog input, analog output, digital input and digital output. It is not intended that spare points be provided in unitary control panels which serve classroom unit ventilators. It is intended that spare points be provided in master control panels and in panels which serve mechanical rooms and air handling units.

2.5 ELECTRONIC SENSORS

A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.

B. Thermistor Temperature Sensors and Transmitters:
   1. Accuracy: Plus or minus 0.5 deg F (0.3 deg C) at calibration point.
   2. Wire: Twisted, shielded-pair cable.
   3. Insertion Elements in Ducts: Single point, 8 inches (200 mm) long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft. (0.84 sq. m).
   4. Averaging Elements in Ducts: 36 inches (915 mm) long, flexible; use where prone to temperature stratification or where ducts are larger than 10 sq. ft. (1 sq. m).
   5. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches (64 mm).
   6. Room Sensor Cover Construction: See below.
   7. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
   8. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

C. Pressure Transmitters/Transducers:
   1. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
      a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
      b. Output: 4 to 20 mA.
      c. Duct Static-Pressure Range: 0- to 5-inch wg (0 to 1240 Pa).
   2. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig (1034-kPa) operating pressure and tested to 300-psig (2070-kPa); linear output 4 to 20 mA.
   3. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.

D. Room Sensor Cover Construction: Manufacturer's standard locking covers.
   1. Set-Point Adjustment: Concealed.
   2. Set-Point Indication: Concealed.

3. Thermometer: Concealed.
4. Communications Port: Standard phone-type jack for connection of portable laptop computer and other devices. Provide at each room sensor, no exceptions.
5. Override Pushbutton: For timed override of occupied/unoccupied cycle. Provide in normally-occupied rooms such as classrooms and offices only.

E. Room sensor accessories include the following:
1. Insulating Bases: For sensors located on exterior walls.
2. Adjusting Key: As required for calibration and cover screws. Furnish to the Owner, at least 5 per sensor type.
3. Wall Mounting Box: Recessed, steel, securely fastened to wall framing. Equal to Steel City metallic switch boxes by Thomas & Betts Corp. Box may only be omitted where sensor attaches directly to masonry construction.

2.6 STATUS SENSORS

A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg (0 to 1240 Pa).

B. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.

C. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.

D. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.

E. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.

F. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

G. 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.

2.7 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
1. Comply with requirements in Division 23 Section "Motors, Drives & Accessories."
2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
3. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2 (DN 65): Size for running torque of 150 in. x lbf (16.9 N x m) and breakaway torque of 300 in. x lbf (33.9 N x m).

4. Spring-Return Motors for Valves Larger Than NPS 2-1/2 (DN 65): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).
5. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running torque of 150 in. x lbf (16.9 N x m) and breakaway torque of 300 in. x lbf (33.9 N x m).
6. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).

B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
1. Manufacturers:
   a. Belimo.
2. Valves: Size for torque required for valve close off at maximum pump differential pressure.
3. Dampers: Size for running torque calculated as follows:
   a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. (86.8 kg-cm/sq. m) of damper.
   b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. (62 kg-cm/sq. m) of damper.
   c. Dampers with 2- to 3-Inch wg (500 to 750 Pa) of Pressure Drop or Face Velocities of 1000 to 2500 fpm (5 to 13 m/s): Increase running torque by 1.5.
   d. Dampers with 3- to 4-Inch wg (750 to 1000 Pa) of Pressure Drop or Face Velocities of 2500 to 3000 fpm (13 to 15 m/s): Increase running torque by 2.0.
4. Coupling: V-bolt and V-shaped, toothed cradle.
5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
6. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
7. Power Requirements (Two-Position Spring Return): 24-V ac.
8. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
9. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
10. Temperature Rating: 40 to 104 deg F (5 to 40 deg C).
    a. In addition, valve actuators shall be suitable for the anticipated ambient temperature and fluid temperature. For example, actuators located within heating equipment terminal enclosures will experience higher temperatures.
11. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F (Minus 30 to plus 121 deg C).
12. Run Time: 30 seconds.
13. Actuator Housing: Molded or die-cast zinc or aluminum. Terminal unit actuators may be high-impact plastic with ambient temperature rating of 50 to 140 deg F (10 to 60 deg C) unless located in return-air plenums.
14. Damper actuators shall be provided with end switches.

2.8 CONTROL VALVES

A. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.
1. Globe-type valves are required except for those applications where terminal-unit control valves or butterfly valves are specified or detailed.
2. Ball-type valves may be substituted for other types, and shall be manufactured by Belimo, with Belimo actuators (no substitutions).

3. Valves shall be suitable for water with up to 50 percent inhibited ethylene or propylene glycol.
4. 3-way valves shall be mixing pattern, except where diverting pattern is specified, or where manufacturer requires use of diverting pattern.
5. Rubber-paddle or ball-plug type control valves such as, but not limited to, Honeywell Fan-Coil Valves or the TAC Erie product line (division of Schneider Electric) are not allowed.
6. Valves with thermal-wax motors are not allowed.
7. Valves requiring cartridge replacement for service are not allowed.
8. Valves requiring special water treatment such as 50-micron filtration are not allowed.

B. Sizing: Maximum pressure drop determined with valve full-open at design flow rate and the following:
1. Two Position: Line size.
2. Two-Way Modulating: Between one-half and one times the variable-flow load pressure drop, but not to exceed 3 psig (21 kPa).
3. Three-Way Modulating: Between one-half and one times the variable-flow load pressure drop, but not to exceed 1.5 psig (10.5 kPa).
4. Note: For modulating valves, the load pressure drop is that across the modulated portion of the system. For example, for a 3-way valve providing reset-water control at a boiler, the modulated flow is across the boiler and accessories, whereas the building loop to terminal equipment is considered constant-flow for the purposes of this valve's sizing. For a 3-way valve modulating the flow thru a coil, the coil and its pipe fittings comprise the variable-flow load. For a 3-way valve in a primary-secondary loop to a coil, where the flow thru the coil is a constant pumped flow, the variable load is in the primary-secondary bridge.

C. Hydronic system globe valves shall have the following characteristics:
1. NPS 2 (DN 50) and Smaller: Class 125 bronze (or red brass) body, bronze or brass seat, bronze trim, rising stainless steel stem, renewable brass or composition disc or plug, screwed ends, with backseating capacity, repackable under pressure. Valve may have integral union ends. Valves with ends other than threaded or factory-integral unions are not allowed.
2. NPS 2-1/2 (DN 65) and Larger: Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.
3. Internal Construction: Replaceable plugs and stainless-steel or brass seats.
    a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom.
    b. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom.
4. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics through one of the ports, equal percentage through the other.
5. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for 2-way valves, and 100 percent of pressure differential across valve or 100 percent of total system (pump) head for 3-way valves.
6. Temperature Rating: 250 deg F (121 deg C).

2.9 DAMPERS

A. Manufacturers:
   1. Non-Insulated Dampers:
      a. Ruskin - Model CD60.
      b. American Warming & Ventilating.
      c. Arrow.
      d. Greenheck.
      e. Tamco (T.A. Morrison & Co., Inc.).
   2. Insulated-Blade Dampers:
      a. T.A. Morrison & Co., Inc.; Tamco Series 9000 SC “Severe Cold Option” dampers.
      b. Ventex, Inc. - Series 3965 SC.

B. Non-Insulated Dampers:
   1. AMCA-rated, parallel (two-position) or opposed-blade (modulating) design.
   2. Frames shall be 16 ga. (1.6 mm) thick galvanized steel, reinforced to equivalent strength of 11 ga. (3 mm) galvanized steel; or 0.125 inch (3.2 mm) minimum thickness extruded-aluminum.
   3. Blades shall be airfoil type of not less than 14 ga. (2 mm) equivalent thickness galvanized steel or heavy gauge extruded aluminum, with maximum blade width of 8 inches (200 mm) and length of 48 inches (1220 mm).
   4. Secure blades to 1/2 inch (13 mm) diameter, hex-profile, zinc-plated axles using zinc-plated hardware, with oil-impregnated sintered bronze or nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
   5. Operating Temperature Range: From -40 to 200 deg F (-40 to 93 deg C).
   6. Edge Seals, Low-Leakage Applications: Replaceable, inflatable blade edging of Ruskiprene, neoprene, vinyl, or rubber, and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft (50 L/s per sq. m) of damper area, at differential pressure of 4-inch wg (1 kPa) when damper is held by torque of 50 in.-lbf (5.6 N-m); when tested according to AMCA 500D-98.

C. Insulated Dampers: Dampers which are located in or 4 ft (1.2 m) or less from outside walls or roof lines, and are 8 sq. ft (0.74 sq. m) or larger, shall be thermally insulated type.
   1. Frame: Extruded aluminum, externally insulated with polystyrene foam.
   2. Blades: Double wall extruded aluminum, with internal injected polyurethane foam, thermally broken. Extruded silicone frame and blade seals, secured in slots in the aluminum extrusions. R-value of complete blade shall be 2.29 hr-sq. ft-deg F/Btu (0.39 sq. m-deg K/W).
   3. Leakage shall not exceed 4.9 cfm per sq. ft (25 L per sq. m) against 4-inch wg (1kPa) differential static pressure at -40 deg F (-40 deg C).
   4. Bearings: Celcon inner bearing fixed to a 7/16 inch (11.1 mm) aluminum hexagon blade pin, rotating within a polycarbonate outer bearing inserted in the frame, resulting in no metal-to-metal or metal-to-plastic contact.
   5. Linkage Hardware: Installed in the frame side, constructed of aluminum and corrosion-resistant, zinc-plated steel, with cup-point trunnion screws for a slip-proof grip.
   6. Operating Temperatures: -40 to 155 deg F (-40 to 68 deg C).
   7. For dampers less than 12 inches (305 mm) in one dimension, provide “flanged-to-duct” mounting style for maximum free area.

D. Automatic dampers at exterior wall louvers shall be 4 inches (100 mm) shorter in vertical dimension (height) than the louver they serve, to allow sloping of bottom of duct to drain outward.

2.10 CONTROL CABLE

A. Electronic and fiber-optic cables for control wiring shall be a minimum of cat 6.

2.11 MAIN CONTROL PANEL

A. Main control panel shall be by SCE part # SCE-604-604810LP, description 2DR LP, dimensions 60”x48”x10”.

B. Panel shall be fully wired by BAS Contractor to meet UL Standards.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that power supply and data outlet is available to control units and operator workstation.

3.2 INSTALLATION

A. Install software in control units and operator workstation(s). Implement features of programs to specified requirements and as appropriate to sequence of operation.

B. Connect and configure equipment and software to achieve sequence of operation specified.

C. Provide interconnecting wiring to the communications jack on each room temperature sensor to allow full access to the ATC system from each room sensor.

D. Verify location of room temperature sensors and other exposed control sensors with Drawings and room details before installation.
   1. Install devices 54 inches (1.37 m) above the floor where side approach is possible, and 48 inches (1.22 m) above the floor where front approach is required. Verify mounting heights with authorities having jurisdiction to comply with requirements of the Americans with Disabilities Act (ADA).
   2. Locate in the general location indicated, and coordinate to group together with room light switches and other devices of similar height, to minimize disruption of open wall space.
   3. Locate to not be above electrical dimmers.
   4. Locate to avoid heat-generating equipment such as computers, copiers, cooking equipment, coffee makers, vending machines, and refrigerators. Where electrical outlets are indicated near sensors, verify whether equipment is intended.
   5. Locate to avoid heating piping which may be concealed in partitions.
   6. Locate away from windows and exterior doors.
   7. Locate to avoid other false sources of heat such as strong sunlight.

E. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

F. Provide guards on room sensors and thermostats in the following locations:

1. Public areas other than classrooms and offices, including but not limited to: Corridors, hallways, entrances, lobbies, vestibules, stairwells, toilet rooms and storage rooms.
2. Locations vulnerable to traffic.
3. Where indicated.

G. For components to be installed under other Sections of the Specifications, provide delivery of components to appropriate Subcontractors, provide installation instructions, and supervise their installation.

H. Install hydronic instrument wells, valves, and other accessories according to Division 23 Section "Hydronic Piping."
1. Sensors shall be immersion type in wells unless otherwise specified or indicated.
2. Enlarge piping at wells to prevent excess interference with flow.
3. Locate wells to ensure insertion in active flowing section of piping or tank.
4. Fill sensor wells with thermal heat transfer paste to ensure good conduction.

I. Install automatic dampers according to Division 23 Section "Air Duct Accessories."

J. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures. Provide stand-off brackets of depth to meet or exceed specified thickness of duct insulation.

K. Install duct volume-control dampers according to Division 23 Sections specifying air ducts.

L. Install labels and nameplates to identify control components according to Division 23 Section "Identification for HVAC Piping and Equipment."

M. Install electronic cables according to Division 26.

N. Unless otherwise indicated, actuators shall be spring loaded and shall, upon a loss of power, actuate their device to an appropriate “fail safe” position.
1. Hot water valves - fail safe to fully open.
2. Outside and exhaust air dampers - fail safe to fully closed.

O. For actuators that are required to “fail safe”, provide spring return actuators. “Floating point” actuators shall not be allowed for these applications. “Floating point” actuators shall be allowed for actuators that are not required to “fail safe”.

3.3 INTERFACE WITH FIRE ALARM SYSTEM SHUT DOWN

A. For equipment that is required to shut down upon a fire alarm condition, ensure that equipment is wired through input contacts within the starter enclosure to interface with the building’s fire alarm system. Upon receipt of a signal from the building’s fire alarm system, power to the load side of the starter shall be turned off. Provide circuitry to ensure that power is off whether the starter is in the “AUTO”, “HAND” or “BYPASS” mode. If this feature is not available from the starter manufacturer, provide a contactor on the line side of the starter to accomplish the same function. The contractor shall meet the requirements of Division 26.

3.4 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Provide electrical materials and installation under this Section. Requirements and standards shall be as specified in other Sections and Divisions of the Specifications, as indicated in paragraphs below.

B. Install raceways, boxes, and cabinets according to Division 26.

C. Install building wire and cable according to Division 26.

D. Provide all required conduit for control wiring according to Division 26.

E. Provide interface wiring (line and low voltage) as required to complete ATC system installation.

F. Install signal and communication cable according to Division 26 and 27.
   1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
   2. Install exposed cable in raceway.
   3. Install concealed cable in raceway.
   4. Bundle and harness multi-conductor instrument cable in place of single cables where several cables follow a common path.
   5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
   6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
   7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

G. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

H. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

I. Connect lead-lag controls to lock out the failed or non-selected motor, to prevent simultaneous operation.

J. Connect lead-lag controls so that only one motor can run in starter “hand” position.

K. Connect fire alarm shutdown of motors on the load side of controls and hand-off-auto switches, to prevent motor from running in any switch position during fire alarm.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:
   1. 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.

C. 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.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.6 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. Provide diagnostic and test instruments for calibration and adjustment of system.
11. 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 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.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain Mechanical instrumentation and controls.

3.8 TRAINING

A. Training shall be by the ATC Subcontractor and shall utilize specified manuals and as-built documentation. All training shall be video recorded, with the completed video being turned over to the owner once training has been completed.

B. Operator training shall include 2 two-hour sessions encompassing:
1. Modifying text.
2. Sequence of Operation review.
3. Selection of displays and reports.
4. Use of the specified functions.
5. Setting and adjusting of occupancy schedules.
6. Troubleshooting of sensors.
7. Owner questions/concerns.

PART 4 - SEQUENCES OF OPERATION

4.1 GENERAL

A. Setpoints shall be adjustable by the building operator through the graphic interface on the operator’s workstation desktop PC, and through a portable laptop computer plugged into the system at locations throughout the building.

B. Provide the ability for the Testing and Balancing Agent to connect to the system and change setpoints, to temporarily override setpoints, and to override modes of operation, as may be required for their work.

4.2 ALARMS

A. Provide the capability to generate alarms, complete with individualized per point alarm

message. Disable alarms when their associated system has been disabled as part of a standard control function. For example, when hot water system is inactive during the summer months and hot water temperature drops below the low water temperature alarm set point, do not generate an alarm.

B. Provide capability for BAS to generate an alarm at the fire alarm panel for low steam pressure and a general alarm for all other alarm conditions.

4.3 Heating Mode

1. Heating Mode:
2. Heating mode is automatically enabled when outside air temperature drops below 60 deg F or when there is a call for heating from any space. Heating mode is automatically disabled when the outside air temperature rises above 60 deg F. Enable/disable range shall be user adjustable.
3. Provide manual override points on the graphics screen to allow the Owner to override the automatic heating and cooling modes.

4.4 Heating Boilers (B-1, B-2, B-3)

1. The boilers are operated in a lead / lag arrangement by the Building Automation System (BAS). Connect the boiler controller into the main ATC system for monitoring. Coordinate with Boiler/Burner Controller Manufacturer. BAS shall cycle all three boilers on and off as necessary to accommodate for building heating load. BAS shall disable all three boilers during the summer.

B. Glycol Hot Water Circulating Pumps (P-1, P-2)

1. Pumps are started and stopped through the DDC system on a call for heat from the boiler plant. The lead pump runs continuously in heating mode.
2. The variable frequency drive modulates pump speed based upon loop differential pressure.
    a. Provide differential pressure sensor between the supply and return piping heating loop. Differential pressure sensor shall be located approximately 2/3 of the way down the loop and shall be well mounted within the system piping.
    b. The BAS shall monitor differential pressure for loop. The integral variable frequency drive for the lead pump modulates the pump motor speed to maintain the differential pressure setpoint.
    c. The ATC system monitors VFD status, and other data. If a VFD indicates trouble, an alarm is generated. If the lead-pump VFD indicates trouble, the lead pump and its VFD are locked out and the lag pump is energized.
3. An automatic lead-lag controller alternates lead pump operation on a weekly basis. The operator workstation also provides a manual selection of the lead pump. If the lead pump fails, that pump is locked out. The lag pump is automatically energized, and an alarm is generated at the operator workstation. If the lag pump also fails, a critical alarm is generated at the operator workstation.
4. Operator Station Display: At a minimum, indicate the following on operator workstation display terminal:
    a. Circulating Pumps:
        1) Heating system and pump demand on/off.
        2) Lead/lag pump selection status.
        3) Lead/lag pump manual selection.

4) Lead pump trouble (alarm).
5) Both pumps failure (critical alarm).
6) Pump run time in hours.
7) VFD reference speed.
8) VFD actual speed output.
9) VFD power/amps.
10) VFD trouble alarm.
11) Alarm silencing.
12) Loop differential pressure.

C. Baseboard Radiation
   a. Space sensor: Wall-mounted, blank cover, without setpoint dial or thermometer.
   b. Setpoint: Provide occupied/unoccupied control. Initial setpoints (adjustable).
   c. Operator Station Display: At a minimum, indicate the following on operator workstation display terminal:
      1) Space temperature.

4.5 EXHAUST FAN (EF-1)

A. EF-1 is enabled through BAS to operate continuously.

B. Operator Station Display: At a minimum, indicate the following on operator workstation display terminal:
   1. Exhaust fan on/off command
   2. Exhaust fan airflow status
   3. Fan alarm status

4.6 SUPPLY FANS (SF-1, SF-2, SF-3)

A. Supply fans SF-1, SF-2 and SF-3 shall be interlocked with boilers B-1, B-2 and B-3 respectively. On a call for heat from the lead boiler, BAS shall enable its associated supply fan to operate. BAS shall modulate speed of supply fan through VFD to track modulation of burner.

B. Control valve serving associated glycol heating coil shall modulate as necessary to maintain a discharge air temperature setpoint of 60 deg. (adj.).

C. Space Cooling Mode:
   1. During the off season period when the boilers are shut down, supply fans SF-1, SF-2 and SF-3 shall operate along with L-1 louvers to provide space cooling. A total of six (6) temperature sensors shall be located within the boiler room and averaged to determine space temperature. Upon a rise in space temperature above setpoint, BAS shall open L-1 motorized dampers and enable fans SF-1, SF-2 and SF-3 to maximum scheduled airflows. Once space conditions are satisfied, BAS shall disable fans and close L-1 motorized dampers.

4.7 CONDENSATE RECEIVER AND PUMPS

A. Dual redundant level sensors shall be programmed through BAS to enable/disable lead condensate pump in accordance with the following:

1. On a rise in condensate water level above setpoint, lead condensate pump shall be enabled. Once water level drops below setpoint, pump shall be disabled.
2. If lead condensate pump does not start, BAS shall enable redundant pump and signal an alarm.
3. If condensate level rises above setpoint and neither condensate pump starts, BAS shall signal a high water level alarm.
4. Two redundant float switches shall be stainless steel and slide up/down within independent chambers to provide analog signal output. Ultrasonic switches shall not be acceptable.

4.8 FUEL OIL PUMPSET

A. BAS shall send signal to integral control panel shall enable pumps to operate continuously any time that #2 oil will be consumed. Integral panel shall alternate lead pump based upon a schedule determined by Owner. BAS shall enable pumpset to operate once per week at a scheduled time for one hour anytime that #2 oil will not be consumed.

B. BAS shall monitor integral control panel for status.

4.9 FIRE ALARM SYSTEM SHUT-DOWN INTERFACE

A. For starters that are associated with equipment that is required to be shut down upon a fire alarm condition, provide input contacts within the starter enclosure to interface with the building's fire alarm system. Upon receipt of a signal from the building's fire alarm system, power to load side of the starter is turned off. Circuitry is provided to ensure that power is off whether the starter is in the "AUTO", "HAND" or "BYPASS" mode. If this feature is not available from the starter manufacturer, provide a contactor on the line side of the starter to accomplish the same function. The contactor shall meet the requirements of Division 26.

4.10 RE-START PHASING AFTER POWER INTERRUPTION

A. Upon a power interruption, a loss of power, or at morning start-up, equipment of electrical power greater than or equal to 1.0 HP is started in a staged manner which allows a time delay of 30 seconds between the start of each device.

END OF SECTION 230900

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SECTION 231113 – FACILITY FUEL-OIL PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe and pipe fittings.

B. Valves.

C. Fuel Oil Transfer Pumpset.

1.2 RELATED SECTIONS

A. Division 09 Section “Painting.”

B. Division 23 Section “Hangers and Supports for HVAC Piping and Equipment.”

C. Division 23 Section “Identification for HVAC Piping and Equipment.”

D. Division 26: Electrical characteristics and wiring connections.

1.3 REFERENCES

A. ANSI B31.1 - Power Piping.

B. ANSI B31.4 - Liquid Petroleum Transportation Piping Systems.

C. ANSI B31.9 - Building Service Piping.

D. API 650 - Welded Steel Tanks for Oil Storage.

E. API 2000 - Venting Atmospheric and Low Pressure Storage Tanks.

F. ASME - Boiler and Pressure Vessel Code.

G. ASME SEC IX - Welding and Brazing Qualifications.

H. ASME B16.3 - Malleable Iron Threaded Fittings.

I. ASME B16.18 - Cast Copper Alloy Solder-Joint Pressure Fittings.

J. ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings

K. ASME B16.26 - Cast Bronze Fittings for Flared Copper Tubes.

L. ASME B36.10 - Welded and Seamless Wrought Steel Pipe.

M. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

N. ASTM A234/A234M - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

O. ASTM B88 - Seamless Copper Water Tube (ASTM B88M - Seamless Copper Water Tube).

P. ASTM D2310 - Machine-Made Reinforced Thermosetting Resin Pipe.

Q. ASTM D2996 - Filament-Wound Reinforced Thermosetting Resin Pipe.

R. AWS A5.8 - Brazing Filler Metal.

S. NFPA 30 - Flammable and Combustible Liquids Code.

T. NFPA 31 - Installation of Oil Burning Equipment.

U. UL 80 - Steel Inside Tanks Oil-Burner Fuel.

V. UL 142 - Steel Aboveground Tanks for Flammable and Combustible Liquids.

1.4 SUBMITTALS FOR REVIEW

A. Division 01 Section “Submittal Procedures”: Procedures for submittals.

B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Shop Drawings: Indicate system layout, pipe sizes, location, and elevations.

1.5 SUBMITTALS FOR INFORMATION

A. Division 01 Section “Submittal Procedures”: Procedures for submittals.

B. Certificates: Certify that Products meet or exceed specified requirements.

1.6 SUBMITTALS AT PROJECT CLOSEOUT

A. Division 01 Section “Closeout Procedures”: Procedures for submittals.

B. Project Record Documents: Record actual locations of piping system, storage tanks, and system components.

C. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.7 QUALITY ASSURANCE

A. Welding Materials and Procedures: Conform to ASME Code.

B. Welders Certification: In accordance with ASME SEC IX, NCPWB Standard Procedure Specifications.

C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

D. Installer Qualifications: Company specializing in performing the work of this section with minimum three years experience.

E. Valves: Manufacturer's name and pressure rating marked on valve body.

1.8 REGULATORY REQUIREMENTS

A. Conform to applicable EPA Regulations for installation of fuel oil system.

B. Conform to ANSI B31.1 for installation of fuel oil piping.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.9 DELIVERY, STORAGE, AND PROTECTION

A. Division 01 Section “Product Requirements”: Transport, handle, store, and protect products.

B. Protect piping and fittings from soil and debris with temporary end caps and closures. Maintain in place until installation.

C. All primary tanks must be vented. Tanks are designed for operation at atmospheric pressure only. Tank shall be capable of storing petroleum products with specific gravity up to 1.1. Tanks shall be chemically inert to petroleum products.

PART 2 - PRODUCTS

2.1 ABOVE GROUND PIPING

A. Copper Tubing: ASTM B88 (ASTM B88M), Type K, annealed.
1. Fittings: ASME B16.26, cast bronze.
2. Joints: Flared.

B. Steel Pipe: ASTM A53 or ASME B36.10, Schedule 40 black.
1. Fittings: ASTM B16.3, malleable iron, or ASTM A234/A234M, wrought carbon steel and alloy steel welding type.
2. Joints: NFPA 30, threaded or welded to ANSI B31.1, ANSI B31.4, ANSI B31.9.

C. FRP: ASTM D2310 and ASTM D2996, UL listed filament wound fiberglass reinforced epoxy pipe with integral epoxy liner and exterior coating.
1. Fittings: Compression molded, filament wound fiberglass reinforced epoxy.
2. Joints: Tapered bell and spigot adhesive bonded.

2.2 BURIED PIPING

A. FRP: ASTM D2310 and ASTM D2996, UL listed filament wound fiberglass reinforced epoxy pipe with integral epoxy liner and exterior coating.
1. Fittings: Compression molded, filament wound fiberglass reinforced epoxy.

B. Joints: Tapered bell and spigot adhesive bonded.

2.3 PIPE HANGERS AND SUPPORTS

A. Conform to NFPA 31, ANSI B31.1, ANSI B31.4.

B. Hangers for Pipe Sizes 1/2 to 11/2 inch (15 to 40 mm): Malleable iron, adjustable swivel, split ring.

C. Hangers for Pipe Sizes 2 inches (50 mm) and Over: Carbon steel, adjustable, clevis, double nutted and washered.

D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

E. Wall Support for Pipe Sizes to 3 inches (80 mm): Cast iron hook.

F. Vertical Support: Steel riser clamp or angle ring.

G. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

H. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.4 FLANGES, UNIONS, AND COUPLINGS

A. Pipe Size 2 inches (50 mm) and Under:
1. Ferrous pipe: 150 psi (1034 kPa) malleable iron threaded unions.
2. Copper tube: 150 psi (1034 kPa) bronze unions with brazed joints.

B. Pipe Size Over 2 inches (50 mm):
1. Ferrous pipe: 150 psi (1034 kPa) forged steel slip-on flanges; 1/16 inch (1.6 mm) thick preformed neoprene gaskets.
2. Copper tube: 150 psi (1034 kPa) slip-on bronze flanges; 1/16 inch (1.6 mm) thick preformed neoprene gaskets.

2.5 BACK PRESSURE REGULATING VALVE

A. Manufacturers:
1. Preferred Utilities.
2. Firomatic.
3. Wheaton.

B. Self operating spring loaded, cast iron body, suitable for use with fluid temperature up to 200 deg. F, threaded ends.

2.6 BALL VALVES

A. Manufacturers:
1. Preferred Utilities.
2. Firomatic.
3. Wheaton.

B. MSS SP-110, Class 150, 400 psi (2760 kPa) CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle, solder or threaded ends with union.

2.7 SWING CHECK VALVES

A. Manufacturers:
1. Preferred Utilities.
2. Firomatic.
3. Wheaton.

B. MSS SP-80, Class 150, bronze body and cap, bronze swing disc, solder or threaded ends.

2.8 RELIEF VALVES

A. Manufacturers:
1. Preferred Utilities.
2. Firomatic.
3. Wheaton.

B. Bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated at maximum 60 psi (400 kPa), UL listed for fuel oil, capacities ASME certified and labeled.

2.9 STRAINERS

A. Manufacturers:
1. Preferred Utilities.
2. Wheaton.
3. OPW.

B. Threaded brass body for 175 psi (1200 kPa) CWP, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.

2.10 FLEXIBLE CONNECTORS

A. Manufacturers:
1. Mason.
2. Metraflex.
3. Kee-Flex.

B. Bronze inner hose and braided exterior sleeve, suitable for minimum 200 psi (1380 kPa) CWP and 250EF (121EC).

2.11 FUEL OIL TRANSFER PUMPS AND STRAINING SET

A. Provide and install a factory assembled "Packaged" Duplex Fuel Oil Pump Set. The set shall have components mounted on a steel base support fabricated of ¼ inch steel plate with 3 inch steel side rails continuously welded to the base. Standard Containment Basin shall encompass the entire perimeter of the duplex pump set and no components or factory piping shall overhang this basin. Base support shall be fabricated with 2-3/4 inch overflow lip which forms a minimum 6 gallon pump set Containment Basin. Base shall be grouted in the field to the

housekeeping pad to minimize vibration and movement. Provide a ½ inch plugged drain connection in the Containment Basin. The base shall be provided with steel brackets for mounting and support of the electrical control cabinet. Wiring and piping shall be covered by labels of nationally recognized Trade Unions. Pipe shall be schedule 40, ASTM Grade A-106 Black pipe with 150# Threaded, Malleable Iron fittings. The Set shall consist of but not be limited to the following components:

1. Two (2) fuel oil pumps, each with a capacity as scheduled. Pumps shall be of the positive displacement internal gear, rotary type, with a mechanical face type seal, outboard sleeve bearing and a two bolt flange mounted foot. The pumps shall be capable of developing 25 inch Hg. vacuum at 0 psig as factory tested, however for normal operation, vacuum at the inlet of the pump shall not exceed 15 inch Hg. Pump housing shall be designed to permit disassembly without breaking piping connections. The pump rotor assembly shall be in hydraulic axial balance so as to eliminate end thrust. The pump housing, housing cover, and mounting foot shall be gray cast iron. The pump housing bushing shall be Teflon impregnated sintered powdered metal. The pump rotor and shaft assembly shall be machined steel. The idler shall be sintered powder metal. The idler pin shall be hardened high carbon steel. The mechanical face type seal rotating ring shall be carbon, the stationary seat shall be ni-resist and the seal elastomer shall be suitable for the fluid pumped. Pumps shall be as manufactured by Preferred Utilities Mfg. Corp. Danbury, CT, Northern Pump Minneapolis, MN. or McNally Industries, Inc.. Pumps constructed of bronze, brass, aluminum or other soft metals, or pumps that use lip seals, will not be acceptable.
2. Pumps and motors shall be mounted on a structural steel channel and be equipped with a flexible coupling and full OSHA approved coupling guard. Pumps and motors shall be mounted with bolts threaded into the steel channel for ease of maintenance. Mounting bolts shall not penetrate the pump set containment basin.
3. Provide a 1 inch NPT Duplex fuel oil strainer for the suction side of the pump set. Strainer shall produce less than 1/2 psi pressure drop through a clean strainer basket with the maximum anticipated flow in the suction line. Strainer shall have one piece cast-iron body and shall be suitable for pressure to 200 psi. Strainer shall come complete with lever wrench handle. Strainer shall be No. 50 as supplied by Preferred Utilities Mfg. Corp.
4. Suction strainer shall be equipped with a Differential Pressure Switch/Indicator. The Differential Pressure Switch shall be wired to provide indication to the pump set control panel that strainer baskets need to be shifted and cleaned. The Differential Pressure Indicator shall provide clear indication of strainer basket status with the use of a Tri-Colored Scale Plate with GREEN denoting Clean, YELLOW denoting Change and RED denoting Dirty. The Switch/Indicator shall be rated for 200°F and 300 PSIG, with BUNA-N seals, and be mounted with isolation cocks.
5. Two 1/2 inch (12.7 mm) NPT fuel oil pump relief valves with an adjustable range. Valve shall be sized to relieve the full flow of the pump without causing the pump motor to overload or any component's pressure rating to be exceeded if the discharge is inadvertently valved off. Relief valves shall be externally mounted on the set to be piped to the return line in the field. Internal relief valves will not be accepted. Relief valves shall be as supplied by Preferred Utilities Mfg. Corp. Type R
6. Provide 2 class 125, threaded, bronze body, "Y" type, swing check valves. Valves to have a re-grindable bronze seat, and a threaded cap. Valves shall be located on discharge side of each pump.
7. Ball valves shall be provided on both the suction and discharge of each pump to provide pump isolation for service. Valves shall be of 2 piece bronze bodied construction with chrome plated ball. Valves shall have bottom loaded pressure retaining stems, glass

reinforced Durafill seats and reinforced PTFE stem packing seals. Valves shall be rated 600# WOG with a CV value of not less than 15.0.

8. One (1) 4" dial compound gauge mounted on the inlet to the suction strainer. Gauge shall be liquid filled to dampen pulsation, with bright finished stainless steel case, brass movement, bronze bourdon tube, and shall be furnished with a pulsation dampening orifice. Gauges shall be readable from the front of the set at a distance of 20 feet. Gauge shall read 30 inches hg - 0 - 15 psig. Gauges shall be mounted with isolation cocks.
9. Two (2) 4 inch dial pressure gauges shall be placed on discharge side of each pump. The gauges shall be liquid filled to dampen pulsation, have bright finished stainless steel case, brass movement, bronze bourdon tube, and shall be furnished with a pulsation dampening orifice. Gauges shall be readable from the front of the set at a distance of 20 feet. Gauge shall read 0 -50 psig. Gauges shall be mounted with isolation cocks.
10. Provide a leak sensor in the Pump Set Containment Basin to shut off the pumps and energize an audible and visual alarm should a leak be detected. The level sensor shall be float operated, with the float being of plasma welded stainless steel construction. The float shall be suitable for temperatures up to 250 degrees F and pressures up to 300 PSI.
11. Provide a time delayed flow sensing switch on the discharge of the pump set to bring on the lag pump should the lead pump fail to maintain flow. Flow switch shall be vane operated to actuate a single double throw snap switch. Switch will be wired back to the main control cabinet for alarm and annunciation. Switch shall be rated for 1450 PSIG.

B. Fuel Oil Management Control Center

1. Provide a pumpset mounted fuel oil management control cabinet to monitor and control the fuel oil delivery system in response to the demand. Cabinet shall be completely pre-wired, tested and shipped as an integrated system to insure jobsite reliability. System shall be custom designed to accomplish the control strategy as outlined. Control strategy shall be Microprocessor based and utilize a PLC (Programmable Logic Controller). Relay logic is not acceptable. Cabinet shall be manufactured by nationally recognized trade union personnel. Cabinet mounted devices and construction methods shall be in compliance with UL 508. The cabinet shall be labeled as complying with UL 508 by an OSHA Nationally Recognized Testing Laboratory (NRTL) such as UL, ETL, or equal. The control cabinet manufacturer shall be inspected quarterly by a NRTL to insure continuous compliance with UL 508 construction requirements. System manufacturer shall have factory employed field service engineers, specializing in microprocessor based control systems. Fuel oil handling system shall be purchased from one manufacturer to insure single source responsibility and quality assurance. System shall be as manufactured by Preferred Utilities Mfg. Corp., Model FMCC-1297-JJG
2. Cabinet enclosure shall be constructed of a minimum of 14 gauge steel, continuously welded and constructed to NEMA 12 / 13 standards. Doors shall be fully gasketed with a turned edge and piano hinges. Cabinet interior shall be primed and finished in a white gloss, chemical resistant enamel. Cabinet exterior shall be primed and finished in a durable chemical resistant, textured gray enamel, suitable for industrial environments.
3. PLC shall have 2.5K of EEPROM program memory with battery backup. There shall be (2) two direct connection communication ports, one shall be used for Operator Interface. The PLC shall have (4) four LED Status Indicators. The LED's shall indicate CPU and battery power, CPU RUN mode and status of PLC internal diagnostics test. PLC Inputs shall be rated for an operating voltage of 80-132 VAC, with 8 inputs per module. Outputs shall be form A rated for 5-240 VAC with 8 outputs per module.
4. PLC shall have sufficient I/O to accomplish necessary control functions. The control strategy shall be burned into an EPROM at the factory, and shall be safeguarded against

re-configuration by un-authorized / un-qualified personnel. The PLC shall be designed so that it will "fail safe" in the event there is a microprocessor failure.

5. PLC shall provide for a minimum of (8) dry contacts to be interfaced with the Building Maintenance System as required. Factory set signals shall include Pump Failure, Pump Set Leak, Day Tank High Level, Low Level and Leak.
6. Flush mounted in the control panel shall be a Combination Annunciator / Keypad (CAK) with a NEMA 4 rated front panel. The Combination Annunciator / Keypad shall be factory programmed to communicate with the PLC via RS232/RS422 communication cable with an adjustable baud rate of 4800 to 19200. The Keypad portion shall consist of 12 tactile snap membrane pushbuttons. Pushbuttons shall be programmable for either momentary or maintained action. Pushbuttons shall have individual LED indicators to mirror its status (On/Off). Factory set pushbuttons shall include Alarm Silence, Alarm Reset, Lamp/Alarm Test and Lead Pump Selection.. The Annunciator portion shall consist of 12 backlit LED lamps with factory set legends depicting lamp function. The lamps shall be programmable for either maintained or flashing action. Lamps shall be factory programmed to flash during equipment malfunction. Factory set lamps shall be (2) Pump On, (2) Pump Fail, Pump Set Leak, Strainer High Differential, Day Tank High, Day Tank Low and Day Tank Leak.
7. Cabinet wiring shall be run in NEMA approved covered wireways, and terminate at a numbered terminal strip to facilitate field connections to remote equipment. Fuel oil pump motor starters shall be 3 phase open frame, 120 volt coil, NEMA sized to match the pump motors. Three pole circuit breakers shall have a 10,000 Ampere interrupting capacity.
8. Switches shall have maintained contacts. Provide a single lamp / alarm test push-button to test the function of lights and alarm circuits. Cabinet front devices shall be identified by black acrylic or phenolic plastic labels with engraved white lettering. Cabinet shall consist of but not be limited to the following:
    a. Micro processor based Programmable Logic Controller (PLC) for fuel oil handling system alarms and control functions.
    b. Combination Annunciator / Keypad
    c. Press to test button for alarms and indicating lights (CAK)
    d. Magnetic motor starters with overload protection.
    e. Motor circuit breakers.
    f. Control circuit transformer. (If required)
    g. Hand-off-Auto switch for each pump.
    h. Lead Pump alternator logic for normal cycling and pump failure conditions.
    i. Lead pump selector switch, with alternating lead lag. (CAK)
    j. Manual reset push-button (CAK)
    k. Alarm bell
    l. Alarm silence push-button. (CAK)
    m. Strainer basket high differential alarm
    n. Indicating lights as follows:
        1) (1) Power on light
        2) (2) Pump running (CAK)
        3) (2) Pump failure (CAK)
        4) (1) Pump Set Leak (CAK)
        5) (1) Str. high differential (CAK)

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals. Install to NACE RP-01-69.

C. Route piping in orderly manner and maintain gradient.

D. Install piping to conserve building space and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide clearance for access to valves and fittings.

H. Provide access where valves and fittings are not exposed.

I. Where pipe support members are welded to structural building framing, scrape, brush clean, weld, and apply one coat of zinc rich primer.

J. Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting.

K. Identify piping systems.

L. Install valves with stems upright or horizontal, not inverted.

M. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

3.3 Manufacturer shall provide factory startup and calibration to be executed as needed during installation for the complete Fuel Oil Handling System, and after installation to train owners personnel. THIS REQUIREMENT SHALL NOT BE WAIVED BY THE INSTALLING CONTRACTOR. A letter from the Fuel Oil Management Systems manufacturer shall be provided to the mechanical engineer stating that the system received its factory start up and that components are in working order.

END OF SECTION 221113

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SECTION 232113 – HYDRONIC PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe and Pipe Fittings For:
   1. Glycol heating water piping system.
   2. Boiler feed-water piping
   3. Boiler blow-down piping.
   4. Relief-valve piping.
   5. Chemical feed piping.
   6. Boiler water sample piping.

B. Valves:
   1. Gate valves.
   2. Globe or angle valves.
   3. Ball valves.
   4. Plug valves.
   5. Butterfly valves.
   6. Check valves.

1.2 RELATED SECTIONS

A. Division 23 Section “Hangers and Supports for HVAC Piping and Equipment.”

B. Division 23 Section “Identification for HVAC Piping and Equipment.”

C. Division 23 Section “HVAC Piping Insulation.”

D. Division 23 Section “Hydronic Specialties.”

1.3 REFERENCES

A. ASME - Boiler and Pressure Vessel Codes, SEC 9 - Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.

B. ASME B16.3 - Malleable Iron Threaded Fittings Class 50 and 300.

C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

D. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

E. ASME B31.5 - Refrigeration Piping.

F. ASME B31.9 - Building Services Piping.

G. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.

H. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

I. ASTM B32 - Solder Metal.

J. ASTM B88 - Seamless Copper Water Tube.

K. ASTM D1785 - Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

L. ASTM D2235 - Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

M. ASTM D2241 - Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR-Series).

N. ASTM D2310 - Machine-Made Reinforced Thermosetting Resin Pipe.

O. ASTM D2466 - Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

P. ASTM D2467 - Socket-Type Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

Q. ASTM D2680 - Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite-Sewer Piping.

R. ASTM D2683 - Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.

S. ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.

T. ASTM D2855 - Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

U. ASTM D3309 - Polybutylene (PB) Plastic Hot-and Cold-Water Distribution Systems.

V. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

W. ASTM F708 - Design and Installation of Rigid Pipe Hangers.

X. ASTM F2389 - Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems

Y. ASTM F845 - Plastic Insert Fittings for Polybutylene (PB) Tubing.

Z. ASTM F876 - Crosslinked Polyethylene (PEX) Tubing.

AA. ASTM F877 - Crosslinked Polyethylene (PEX) Plastic Hot - and Cold - Water Distribution Systems.

BB. AWS A5.8 - Brazing Filler Metal.

CC. AWS D1.1 - Structural Welding Code.

DD. AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids.

EE. AWWA C110 - Ductile - Iron and Grey -Iron Fittings 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.

FF. AWWA C111 - Rubber-Gasket Joints for Ductile Iron and Grey-Iron Pressure Pipe and Fittings.

GG. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.

HH. CSA B137.11 - Polypropylene (PP-R) Pipe and Fittings for Pressure Applications

1.4 SUBMITTALS

A. Submit under provisions of Division 01 Section “Submittal Procedures.”

B. Product Data: Include data on pipe materials, pipe fittings, valves, and accessories. Provide Manufacturers catalogue information. Indicate valve data and ratings.

C. Welders Certificate: Include welder’s certification of compliance with ASME SEC 9 and AWS D1.1.

D. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01 Section “Closeout Procedures.”

B. Record actual locations of valves.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 01 Section “Operation and Maintenance Data.”

B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing the work of this section with minimum three years experience.

C. Welders: Certify in accordance with ASME SEC 9. and AWS D1.1.

1.8 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 code for installation of piping system.

B. Welding Materials and Procedures: Conform to ASME SEC 9 and applicable state labor regulations.

C. Provide certificate of compliance from authority having jurisdiction indicating approval of welders.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division 01 Section “Product Requirements.”

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 - PRODUCTS

2.1 GLYCOL HEATING WATER, BOILER FEED-WATER, BOILER BLOW-DOWN AND RELIEF-VALVE PIPING, BOILER WATER SAMPLE PIPING, ABOVE GROUND

A. Steel Pipe: ASTM A53, Schedule 40 for sizes less than 12 inch (300 mm), 0.375 inch (10 mm) wall for sizes 12 inch (300 mm) and over, black.
   1. Fittings: ASTM B16.3, malleable iron or ASTM A234, forged steel welding type fittings.
   2. Joints: Schedule 40 threaded for pipe sizes 2" (50.8 mm) and smaller, and AWS D1.1, welded for pipe sizes 2 1/2" (63.5 mm) and larger.
   3. Grooved and Shouldered Pipe End Couplings: As specified in this Section, with grooved steel pipe, is an acceptable alternate to the above for water service operating at temperatures from -30EF to +230EF, utilizing grade E, EPDM gasket compound.

2.2 UNIONS, FLANGES, AND COUPLINGS

A. Unions for Pipe 2 Inches (50 mm) and Under:
   1. Ferrous Piping: 150 psig (1034 kPa) malleable iron, threaded.
   2. Copper Pipe: Bronze, soldered joints.
   3. Polypropylene Pipe:
      a. Manufacturer: Aquatherm, Greenpipe product line, no substitutions.
      b. Polypropylene with polypropylene nut or brass nut.

B. Flanges for Pipe Over 2 Inches (50 mm):
   1. Ferrous Piping: 150 psig (1034 kPa) forged steel, slip-on.
   2. Copper Piping: Bronze.
   3. Polypropylene Pipe:
      a. Manufacturer: Aquatherm, Greenpipe product line, no substitutions.
   4. Gaskets: 1/16 inch (1.6 mm) thick preformed neoprene or EPDM, reinforced as required for the system operating pressure, up to relief valve setting.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.3 CHEMICAL FEED PIPING

A. Stainless Steel Piping:
   1. Standards: ASME B31.1, ASME B31.3, ASME B31.9, ASTM A312, and NSF 61.
   2. Stainless steel, Type 304 (with orange stripe). Inert gas welded.

B. Pipe outer dimensions conform to ASME B88 (copper tubing sizes). Pipe wall thickness conforms to the requirements of schedule 5S steel pipe per ASME B36.10M, to provide pressure and temperature ratings conforming to ASME B31.9.

2.4 VALVES

A. Manufacturers:
1. Nibco.
2. Apollo.
3. Victaulic Company.
4. Watts.
5. Wheatley.
6. No substitutions.

B. Gate Valves Over 2 Inches (50 mm):
1. Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends.
2. 125 lb S.W.P., 200 lb W.O.G.

C. Globe or Angle Valves:
1. Up To and Including 2 Inches (50 mm):
   a. Bronze body, bronze trim, screwed or union bonnet, rising stem and handwheel, inside screw, renewable composition disc and bronze seat, solder or threaded ends.
   b. 150 lb S.W.P., 300 lb W.O.G.
2. Over 2 Inches (50 mm):
   a. Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, rotating plug-type disc with renewable seat ring and disc, flanged ends.
   b. 125 lb S.W.P., 200 lb W.O.G.

D. Ball Valves:
1. Up To and Including 2 Inches (50 mm):
   a. Bronze two piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle, solder or threaded ends.
   b. 150 lb S.W.P., 600 lb W.O.G.
2. Over 2 Inches (50 mm):
   a. Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle, flanged.
   b. 150 lb S.W.P., 285 lb W.O.G.

E. Plug Valves:
1. Up To and Including 2 Inches (50 mm):
   a. Bronze body, bronze tapered plug, 70 percent port opening, non-lubricated, teflon packing, threaded ends.
   b. Operator: One plug valve wrench for every ten plug valves minimum of one.
2. Over 2 Inches (50 mm):
   a. Cast iron body and plug, 70 percent port opening, pressure lubricated, teflon packing, flanged ends.
   b. Operator: Each plug valve with a wrench with set screw.

F. Butterfly Valves:
   1. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer or lug ends, extended neck.
   2. Disc: Aluminum bronze or chrome plated ductile iron.
   3. Operator: 10 position lever handle for shut-off service, infinite position lever handle with memory stop for throttling service, handwheel and gear drive for sizes 8" (203 mm) and larger.
   4. Pressure rating shall be 150 PSI at 225 degrees F (1034 kPa at 107EC).

G. Swing Check Valves:
   1. Up To and Including 2 Inches (50 mm): Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder or threaded ends.
   2. Over 2 Inches (50 mm): Iron body, bronze trim, bronze or bronze faced rotating swing disc, renewable disc and seat, flanged ends.

H. Spring Loaded Check Valves: Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer or threaded lug ends.

2.5 SLEEVES

A. Pipes Through Floors: Form with 16 gage galvanized steel.

B. Pipes Through Beams, Interior Walls, Fireproofing, Potentially Wet Floor: Form with steel pipe or 16 gage galvanized steel unless indicated otherwise on Drawings.

C. Pipes Through Exterior Building Walls, Concrete Walls or Footing: Form with Schedule 40 (galvanized) steel pipe.

D. Size large enough to allow for movement due to expansion and to provide for continuous insulation.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

E. After completion, fill, clean, and treat systems. Refer to Division 23 Section “HVAC Water Treatment.”

3.2 INSTALLATION

A. Install in accordance with Manufacturer's instructions.

B. Install heating water piping to ASME B31.9. Install glycol chilled water piping to ASME B31.5.

C. Route piping in orderly manner, parallel to building structure, and maintain gradient.

D. Install piping to conserve building space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Sleeve pipe passing through partitions, walls and floors:
   1. Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.
   2. Extend sleeves through 2" (50.8 mm) above finished floor level. Caulk sleeves full depth and provide floor plate.
   3. Where piping passes through floor, ceiling or wall, close off space between pipe sleeve and construction with non-combustible insulation or with approved firestopping material when penetrating fire rated floors, ceilings or walls. Provide tight fitting metal escutcheons on both ends of sleeves to prevent movement of sleeve during piping expansion. Escutcheons shall be sized slightly larger than outside diameter of piping and smaller than diameter of sleeve. Escutcheons shall be rigidly secured to walls.
   4. Where piping passes through fire rated floors, ceilings or walls, close off space between pipe insulation and sleeve with approved firestopping material
   5. Install chrome-plated escutcheons where piping passes through finished surfaces.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

H. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Division 23 Section “HVAC Piping Insulation.”

I. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

K. Install valves with stems upright or horizontal, not inverted.

L. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

M. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.

N. Use non-conducting dielectric connections whenever jointing dissimilar metals.

O. Valve Type Selection:
   1. Use gate or ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
   2. Use globe or ball valves for throttling, bypass, or manual flow control services.
   3. Use N.R.S. Gate Valves for general shut-off service in heating system piping 2-1/2" (63.5 mm) and larger.
   4. Use Plug Valves for general throttling applications where indicated.
   5. Use Bronze Globe Valves in throttling applications at control valve bypasses and in expansion

tank connection.

6. Use Bronze Ball Valves for general shut-off service in heating system piping 2" (50.8 mm) and smaller and at heating terminal units 2" (50.8 mm) and smaller, including fin-tube radiation, classroom unit ventilators, convectors and air handling units.
7. Use Combination Balancing, Flow Measuring and Tight Shut-off Valves at terminal heating and cooling units, zone branches and as indicated.
8. Use Bronze Ball Valves for drain valves with hose connections. Provide valve of size indicated; if size isn't indicated, provide at least 3/4" (19 mm) valve size. Provide outlet fitting for standard "garden hose" with 3/4" (19 mm) hose threads. Provide brass cap with retainer chain. Compression-type Aboiler drain valves@ are not allowed.

P. With the exception of valves which must be properly sized to ensure design flow rates (such as balancing valves), valves shall be line sized.

Q. For valves located more than 7 feet (2.1 m) above finished floor in equipment room areas, provide chain operated sheaves. Extend chains to 5 feet (1.5 m) above finished floor and hook to clips arranged to clear walking aisles.

R. Install concealed pipes close to building structure to keep furring to a minimum.

S. Slope water piping 1 inch in 40 feet (1:480) and arrange to drain at low points. Slope piping up in direction of water flow.

T. On closed systems, equip low points with 3/4" (19 mm) drain valves and hose nipples. Provide, at high points of mains, collecting chambers and high capacity float operated automatic air vents. Provide, at high points of branches, manual air vents with air chambers.

U. Use main sized saddle type branch connections for directly connecting branch lines to mains in steel piping if main is at least one pipe size larger than the branch for up to 6" (152 mm) mains and if main is at least two pipe sizes larger than branch for 8" (203 mm) and larger mains. Do not project branch pipes inside the main pipe.

V. Make connections to equipment and branch mains with unions.

W. Pipe used shall be new material, and threads on piping shall be full length and clean cut with inside edges reamed smooth to full inside bore.

X. Caulking of threads will not be allowed on any piping.

Y. Pipe joint compound shall be put on male threads only.

Z. In the erection of mains, special care must be used in the support, working into place without springing or forcing, and proper allowance made for expansion.

AA. Pipes shall be anchored, guided, and otherwise supported, where necessary, to prevent vibration or to control expansion.

BB. Make such offsets as are shown and required to place the pipes and risers in proper position to avoid other work.

CC. Install a sufficient number of unions or flanged fittings to facilitate making possible future alterations or repairs.

DD. Erect piping to provide for the easy passage and noiseless circulation of water under working conditions.

EE. Where welded joints are required, steel piping shall be installed by the use of the oxyacetylene or electric welding process, except immediate connections to accessible equipment may be threaded. Piping shall have butt welds with welding fittings, standard factory fabricated tees, elbows, reducers, caps, and accessories. Branch outlets 2" (50.8 mm) and smaller shall be made by the use of approved welding type 1/2 couplings, "Weldolet" or "Threadolet" fittings.

1. Piping smaller than 2" (50.8 mm) may be installed at the Contractor's option with welding type, or threaded type fittings, except that piping regardless of size concealed in trenches or inaccessible building construction (e.g. concealed behind sheetrock walls or concealed above sheetrock ceilings) shall be welded.
2. Offsets shall be installed with long radius welding elbows.
3. Welding shall be executed only by certified welding mechanics in accordance with the best practice of the trade.

FF. Take branch lines off bottom of mains or at 45 degree bottom angle, as space permits.

GG. Minimum pipe size allowed for heating water, chilled water, steam and condensate piping shall be 3/4" (19 mm). Piping less that 3/4" (19 mm) shall not be allowed for these piping systems.

HH. For isolation valves, control valves and balancing valves located above suspended ceilings and in areas that are not visible to building occupants (for example, mechanical rooms), provide yellow colored surveyors tape. Permanently attach tape to valve handles and run tape down to 10 inches (254 mm) above ceiling or 12 inches (305 mm) below valve handle where ceilings do not exist (for example, mechanical rooms).

II. Standard details for heating coils are based on single coil arrangements. For heating and cooling coils that are supplied in a split coil arrangement, with two or more individual coils, provide additional piping and balancing valves at each coil to ensure that flow through each coil is proportional to the percentage of total coil face area that the coil occupies.

3.3 CLEANING

A. After satisfactory completion of pressure tests, before permanently connecting equipment, strainers, and the like, clean equipment thoroughly, blow and flush piping for a sufficient length of time as directed, so that interiors will be free of foreign matter. Perform cleaning in the presence of an authorized representative of the Architect. Provide a minimum of 10 days notification to the Architect prior to system cleaning.

B. Fill, vent and circulate the system with approved solution in accordance with equipment (boiler, piping, coils, and others) manufacturer's recommendation, allowing it to reach design or operating temperatures. After circulating for 6 (six) hours, drain the system completely and remove and clean strainer screens. Perform cleaning in the presence of an authorized representative of the Architect. Provide a minimum of 10 days notification to the Architect prior to system cleaning.

C. Fill and vent system as required.

D. Manually vent heat transfer units and high points of the system.

E. Adjust the pressure reducing valve to provide minimum of 5 psig (35 kPa) pressure at the highest point of the system.

F. After system has been completely filled, start zone pumps and circulate cold water for a short time to dislodge small air bubbles, and return them to air extraction device.

G. Raise water temperature to 200°F (93°C) while operating pumps.

H. Stop pump and vent radiation and high points of the system. Normal operation may now be started at any time.

3.4 TESTING

A. No joint or section of piping shall be left untested.

B. Before testing piping systems, remove, or otherwise protect from damage, control devices, air vents, and other parts which are not designed to stand test pressures.

C. Test piping for leaks under 100 psig air pressure with soap suds prior to hydrostatic testing.

D. Test piping hydrostatically to one and one-half times the maximum systems operating pressure, but in no case to less than 75 psig, for at least 4 consecutive hours, during which time pressure shall remain constant without pumping.

E. Test and obtain Architect's approval before painting, covering, or concealing piping, including swing joints.

3.5 SCHEDULES

A. Pipe Hanger Spacing

PIPE SIZE		HANGER ROD MAX. HANGER SPACING		HANGER ROD DIAMETER	
Inches	(mm)	Feet	(m)	Inches	(m)
Steel & Stainless Steel Piping					
1/2 to 1- 1/4	12 to 32	6.5	2	3/8	9
1-1/2 to 2	38 to 50	10	3	3/8	9
2-1/2 to 3	62 to 75	10	3	1/2	13
4 to 6	100 to 150	10	3	5/8	15
8 to 12	200 to 300	14	4.25	7/8	22

14 and over	350 and over	20	6	1	25

END OF SECTION 232113

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SECTION 232118 – HYDRONIC SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Air vents.

B. Strainers.

1.2 RELATED SECTIONS

A. Division 23 Section “Meters and Gauges for HVAC Piping.”

B. Division 23 Section “Hydronic Piping.”

1.3 REFERENCES

A. ASME - Boilers and Pressure Vessel Codes, SEC 8-D-Rules for Construction of Pressure Vessels.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. Submit under provisions of Division 01 Section “Submittal Procedures.”

B. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model and dimensions.

C. Submit inspection certificates for pressure vessels from authority having jurisdiction.

D. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01 Section “Closeout Procedures.”

1.6 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 01 Section “Operation and Maintenance Data.”

B. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years’ experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division 01 Section "Product Requirements."

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.9 MAINTENANCE SERVICE

A. Furnish service and maintenance of glycol system for one year from date of substantial completion.

B. Monthly visit to make glycol fluid concentration analysis on site with refractive index measurement instrument. Detail findings with maintenance personnel in writing of corrective actions needed including analysis and amounts of glycol or water added.

PART 2 - PRODUCTS

2.1 AIR VENTS

A. Manual Type: Short vertical sections of 2 inch (50 mm) diameter pipe to form air chamber, with 1/8 inch (3 mm) brass needle valve at top of chamber.

B. Float Type:
   1. Manufacturers:
      a. Bell & Gossett.
      b. Caleffi.
      c. Taco.
      d. Thrush.
      e. Wheatley.
   2. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

C. Washer Type:
   1. Manufacturers:
      a. Bell & Gossett.
      b. Caleffi.
      c. Taco.
   2. Brass with hydroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

2.2 STRAINERS

A. Manufacturers:
   1. Sarco.
   2. Armstrong.
   3. Barnes and Jones.
   4. Bell & Gossett.
   5. Muesco.
   6. Wheatley.

B. Size 2 inch (50 mm) and Under: Screwed brass or iron body for 175 psig (1200 kPa) working pressure, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.

C. Size 2-1/2 inch (65 mm) to 4 inch (100 mm): Flanged iron body for 175 psig (1200 kPa) working pressure, Y pattern with 3/64 inch (1.2 mm) stainless steel perforated screen.

D. Size 5 inch (125 mm) and Larger: Flanged iron body for 175 psig (1200 kPa) working pressure, basket pattern with 1/8 inch (3.2 mm) stainless steel perforated screen.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Where large air quantities can accumulate, provide enlarged air collection standpipes.

C. Provide manual air vents at system high points and as indicated.

D. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

E. Provide valved drain and hose connection on strainer blow down connection.

END OF SECTION 232118

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SECTION 232123 – HYDRONIC PUMPS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pumps with integral speed controllers.

1.2 RELATED SECTIONS

A. Division 23 Section “Common Motor Requirements for HVAC Equipment.”

B. Division 23 Section “HVAC Piping Insulation.”

C. Division 23 Section “Hydronic Piping.”

D. Division 23 Section “Hydronic Specialties”

E. Division 26 “Electrical”

1.3 REFERENCES

A. UL 778 - Motor Operated Water Pumps.

B. NFPA 70 - National Electrical Code.

1.4 PERFORMANCE REQUIREMENTS

A. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading throughout the entire operating range in parallel or individual operation, and operate within 25percent of midpoint of published maximum efficiency curve.

1.5 SUBMITTALS

A. Submit under provisions of Division 01 Section “Submittal Procedures.”

B. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.

D. Millwright's Certificate: Certify that base mounted pumps have been aligned.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 01 Section “Operation and Maintenance Data.”

B. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing, assembly, and field performance of pumps with minimum 3 years' experience.

B. Alignment: Base mounted pumps shall be aligned by a qualified millwright.

1.8 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Pumps, General:
   1. Grundfos.
   2. Taco.
   3. Armstrong.
   4. Bell & Gossett.
   5. Patterson.

2.2 GENERAL

A. Statically and dynamically balance rotating parts.

B. Construction shall permit complete servicing without breaking piping or motor connections.

C. Pumps shall operate at 1750 rpm unless indicated or specified otherwise.

D. Pump connections shall be flanged.

E. Wetted parts shall be compatible with circulated fluid.

2.3 PUMPS WITH INTEGRAL SPEED CONTROLLER

A. Pumps as scheduled, with pump-mounted speed controller.

B. Working Conditions:
   1. Working Pressure: 145 psig (10 bar) maximum.
   2. Minimum Inlet Pressure: 6.5 psig (0.45 bar) at 194 degrees F (90 degrees C).
   3. Fluid Temperature: 230 degrees F (110 degrees C) maximum for short periods, 203 degrees F (95 degrees C) maximum for continuous operation.
   4. Ambient Temperature: 32 to 104 degrees F (0 to 40 degrees C).

C. Casing: Cast iron or stainless steel with flanged pump connections. Wet-varnished finish.

D. Impeller: Stainless steel, or non-metallic composite.

E. Shaft: Stainless steel, tungsten carbide, or aluminum oxide.

F. Bearings: Carbon, with aluminum oxide outer bearing ring, aluminum oxide or silicon carbide inner bearing ring, and stainless steel bearing plate.

G. Stator Housing: Aluminum, with EPDM O-rings.

H. Rotor: Permanent-magnet rotor, with leak-proof stainless steel rotor can.

I. Motor: Variable speed, electronically commutated, synchronous permanent magnet motor, with 3-lead Alpha snap-lock power plug at pump, and flexible power cord for field connection to junction box. Integral motor protection.

J. Speed Controller: Integral pump-mounted frequency converter. Differential pressure control with "Auto-Adapt" function. Pump speed calculated via a built-in induction coil on the stator winding. Differential-pressure and temperature sensor located inside the pump housing. User interface with LED indicators of relative flow and head, operating mode, on-off status, and fault. Pushbuttons for speed settings and power on-off pushbutton. External start/stop input dry contact. 5 selectable operating modes. Speed controller shall communicate to BAS via Modbus RS485 RTU.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide access space around pumps for service. Provide no less than minimum as recommended by manufacturer.

C. Decrease piping from line size with long radius reducing elbows or reducers.

D. Pump inlet conditions shall be as recommended by the pump manufacturer to eliminate system effects.
   1. Provide suction diffusers where indicated. Suction diffusers shall have adequate space provided for strainer removal. Remove fine-mesh start-up strainers after system startup, and hang adjacent to the pump for Architect/Engineer's approval.
   2. Where suction diffusers are not indicated, provide proper straight lengths of inlet piping and long-radius elbows at pump inlets.

E. Support piping adjacent to pump such that no weight is carried on pump casings. Provide necessary brackets or hanger supports as required to relieve the stress on the pumps and piping. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4 inches (102 mm) and over.

F. Provide line sized shut-off valve and strainer on pump suction, and properly sized soft seat check valve and balancing/flow-measuring/shutoff valve on pump discharge.

G. Install pumps with a pressure gauge piped to suction and discharge, with shutoff valves.

H. Lubricate pumps before start-up.

I. Provide labor and materials required to ensure that pump impellers are adequately sized to provide flow rates as indicated. This shall include, but not be limited to, trimming impellers.

END OF SECTION 232123

SECTION 232213 – STEAM AND CONDENSATE HEATING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe and pipe fittings.

B. Valves.

C. Steam piping system.

D. Steam condensate piping system.

1.2 RELATED SECTIONS

A. Division 23 Section “Hangers and Supports for HVAC Piping and Equipment.”

B. Division 23 Section “Identification for HVAC Piping and Equipment.”

C. Division 23 Section “HVAC Piping Insulation.”

D. ASME - Boiler and Pressure Vessel Codes, SEC 9 - Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.

E. ASME B16.3 - Malleable Iron Threaded Fittings Class 150 and 300.

F. ASME B31.1 - Code for Power Piping.

G. ASME B31.9 - Building Services Piping.

H. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

I. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

J. ASTM F708 - Design and Installation of Rigid Pipe Hangers.

K. AWS A5.8 - Brazing Filler Metal.

L. AWS D1.1 - Structural Welding Code.

M. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.

N. MSS SP69 - Pipe Hangers and Supports - Selection and Application.

O. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

1.3 SYSTEM DESCRIPTION

A. When more than one piping system material is selected, ensure systems components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.

B. Use unions, flanges, and downstream of valves and at equipment or apparatus connections. Use dielectric unions where joining dissimilar materials. Do not use direct welded or threaded connections.

C. Provide pipe hangers and supports in accordance with ASTM B31.9 and MSS SP69 unless indicated otherwise.

D. Use ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

E. Use ball valves for throttling, bypass, or manual flow control services.

1.4 SUBMITTALS

A. Submit under provisions of Division 01 Section “Submittal Procedures.”

B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.

C. Welders Certificate: Include welders certification of compliance with ASME/SEC 9 and AWS D1.1.

D. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01 Section “Closeout Procedures.”

B. Record actual locations of valves.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 01 Section “Operation and Maintenance Data.”

B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing the work of this section with minimum three years experience.

C. Welders: Certify in accordance with ASME SEC 9 and AWS D1.1.

1.8 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 and ASME B31.1 code for installation of piping system.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of welders.

C. Welding Materials and Procedures: Conform to ASME SEC 9 and applicable state labor regulations.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division 01 Section "Product Requirements."

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 - PRODUCTS

2.1 LOW PRESSURE STEAM PIPING (15 PSIG (103 kPa) MAXIMUM)

A. Steel Pipe: ASTM A53, Schedule 40 for all sizes, black.
1. Fittings: ASTM B16.3 malleable iron Class 125, or ASTM A234 forged steel Class 125.
2. Joints: Threaded, or AWS D1.1, welded.

2.2 LOW PRESSURE STEAM CONDENSATE PIPING

A. Steel Pipe: ASTM A53, Schedule 80 for all sizes, black.
1. Fittings: ASTM B16.3 malleable iron Class 125, or ASTM A234 forged steel Class 125.
2. Joints: Threaded, or AWS D1.1, welded.

2.3 PIPE SLEEVES

A. See Division 23 Section "Sleeves and Escutcheons for HVAC Piping."

2.4 UNIONS, FLANGES, AND COUPLINGS

A. Unions for Pipe 2 inches (50 mm) and Under:
1. Ferrous Piping: 150 psig (1034 kPa) malleable iron, threaded.
2. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe Over 2 inches (50 mm):
1. Ferrous Piping: 150 psig (1034 kPa) forged steel, slip-on.
2. Copper Piping: Bronze.
3. Gaskets: 1/16 inch (1.6 mm) thick preformed non-asbestos graphite fiber.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.5 VALVES

A. Manufacturers:
1. Nibco.
2. Apollo.
3. Jenkins.
4. Walworth.
5. Stockham.
6. Hammond.
7. Powell.
8. Armstrong.

2.6 GATE VALVES

A. Over 2 inches (50 mm):
1. Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends.
2. 125 lb. S.W.P., 200 lb. W.O.G.

2.7 BALL VALVES

A. Up To and Including 2 inches (50 mm):
1. Bronze two piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder or threaded ends.
2. 150 lb. S.W.P., 285 lb. W.O.G.

B. Over 2 inches (50 mm):
1. Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle, flanged.
2. 150 lb. S.W.P., 285 lb. W.O.G.

2.8 SWING CHECK VALVES

A. Up To and Including 2 Inches (50 mm): Bronze body, bronze trim, bronze rotating swing disc with composition seat, solder or threaded ends.

B. Over 2 inches (50 mm): Iron body, bronze trim, bronze or bronze faced rotating swing disc, renewable disc and seat, flanged ends.

2.9 SLEEVES

A. Pipes Through Floors: Form with 16 gage galvanized steel.

B. Pipes Through Beams, Interior Walls, Fireproofing, Potentially Wet Floor: Form with steel pipe or 16 gage galvanized steel unless indicated otherwise on Drawings.

C. Pipes Through Exterior Building Walls, Concrete Walls or Footing: Form with Schedule 40 (galvanized) steel pipe.

D. Size large enough to allow for movement due to expansion and to provide for continuous insulation and firestopping.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Whenever work is suspended during construction, protect open ends with temporary plugs or caps.

E. After completion, fill, clean, and treat systems. Refer to Division 23 Section "HVAC Water Treatment."

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner, plumb and parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and not interfere with use of space.

D. Sleeve pipe passing through partitions, walls, and floors.
   1. See Division 23 Section "Sleeves and Escutcheons for HVAC Piping."
   2. Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.
   3. Extend sleeves through potentially wet floors 1 inch above finished floor level. Caulk sleeves full depth and provide floor plate.
   4. Where piping passes through floor, ceiling or wall, close off space between pipe and construction with non-combustible insulation. Provide tight fitting metal caps on both sides and caulk.
   5. Install chrome-plated escutcheons where piping passes through finished surfaces.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Provide clearance for installation of insulation and access to valves and fittings.

G. Provide access where valves and fittings are not exposed.

H. Slope steam piping one inch in 40 feet (0.25 percent). Slope piping down in direction of flow. Use eccentric reducers to maintain bottom of pipe level.

I. Slope steam condensate piping one inch in 40 feet (0.25 percent). Provide drip trap assembly at low points and before control valves. Run condensate lines from trap to nearest condensate receiver. Provide loop vents over trapped sections.

J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

K. Prepare unfinished pipe, fittings, supports, and accessories ready for finish painting.

L. Install valves with stems upright or horizontal, not inverted.

M. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

N. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.

O. Use non-conducting dielectric connections whenever jointing dissimilar metals in open systems.

P. Valve Type Selection:
1. Use gate or ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
2. Use ball valves for bypass, or manual flow control services.
3. Use OS&Y Gate Valves at boiler supply and return connection in accordance to the applicable State Boiler Rules and Regulations.
4. Use N.R.S. gate valves for general shut-off service in heating system piping 2-1/2" (63.5 mm) and larger.
5. Use bronze ball valves 2" (50.8 mm) and smaller for general shut-off service in heating system piping 2" (50.8 mm) and smaller.
6. Use gate valves for throttling in steam systems in sizes 8" (203 mm) and larger.

Q. With the exception of valves which must be properly sized to ensure design flow rates and pressure drops (such as control valves), valves shall be line sized.

R. For valves located more than 7 feet (2.1 m) above finished floor in equipment room areas, provide chain operated sheaves. Extend chains to 5 feet (1.5 m) above finished floor and hook to clips arranged to clear walking aisles.

S. Install concealed pipes close to building structure to keep furring to a minimum.

T. Use main sized saddle type branch connections for directly connecting branch lines to mains in steel piping if main is at least one pipe size larger than the branch for up to 6" (152 mm) mains, and if main is at least two pipe sizes larger than branch for 8" (203 mm) and larger mains. Do not project branch pipes inside the main pipe.

U. Use grooved mechanical couplings and mechanical fasteners only in accessible locations.

V. Make connections to equipment and branch mains with unions.

W. Pipe used shall be new material, and threads on piping shall be full length and clean cut with inside edges reamed smooth to full inside bore.

X. Caulking of threads will not be allowed on any piping.

Y. Pipe joint compound shall be put on male threads only.

Z. In the erection of mains, use special care in the support, working into place without springing or forcing, and make proper allowance for expansion.

AA. Anchor, guide, and otherwise support piping, where necessary, to prevent vibration or to control expansion.

BB. Make such offsets as are indicated and required to place the pipes and risers in proper position to avoid other work.

CC. Install a sufficient number of unions or flanged fittings to make future alterations or repairs possible.

DD. Erect piping to provide for the easy passage and noiseless circulation of fluids under working conditions.

EE. Install steel piping by the use of the oxyacetylene or electric welding process, except immediate connections to accessible equipment may be threaded. Piping shall have butt welds with welding fittings, standard factory fabricated tees, elbows, reducers, caps, and accessories. Branch outlets 2" (50.8 mm) and smaller shall be made by the use of approved welding type 1/2 couplings, AWeldolet@ or AThreadolet@ fittings.
1. Piping smaller than 2-1/2" (63.5 mm) may be installed at the Contractor's option with welding type, or threaded type fittings, except that piping regardless of size concealed in trenches or building construction upon completion of building construction shall be welded.
2. Offsets shall be installed with long radius welding elbows.
3. Welding shall be executed only by certified welding mechanics in accordance with the best practice of the trade.

FF. Piping Installation for Steam and Condensate Systems:
1. Take steam supply branches off top of main, either vertically or at a 45-degree angle, as space permits.
2. Provide drip points in steam lines at ends of mains, at points where rise in pipe elevation is required, where necessary to free steam lines from water and where indicated. Each trap used as end of main drip shall have gate valve and Y-type strainer.
3. Provide dirt pocket and trap at bottom of steam risers and at each drip point. Dirt pockets on branch runouts shall be full size of branch. Dirt pockets on mains 3" and smaller shall be 1-1/4" size. Dirt pockets on larger mains shall be 2".
4. Condensate from new piping shall be wasted until condensate is clean and only then shall condensate be returned to the system.

3.3 CLEANING

A. Initially, remove the thermostatic elements from traps and the baskets from strainers and relief valves; open valves, including automatic control valves, and flush the system with water. To ensure entire system will be flushed, valve off the low pressure traps nearest the boilers during the flushing period, then working to the most remote trap, close off intermediate traps. As traps are closed, remove bottom drain plugs to drain the trap bodies, then replace plugs, thermostatic elements and strainers. This procedure is intended to rid systems of loose debris. To conclude the procedure, open valves at trap assemblies.

3.4 TESTING

A. No joint or section of piping shall be left untested.

B. Before testing piping systems, remove, or otherwise protect from damage, control devices and other parts which are not designed to withstand test pressures.

C. Test piping for leaks under 100 psig air pressure with soap suds before performing the hydrostatic test.

D. Test piping hydrostatically to one and one-half times the maximum systems operating pressure, but in no case to less than 75 psig (517 kPa), for at least 4 consecutive hours, during which time pressure shall remain constant without pumping. [Subject welded joints to hammer test while under hydrostatic pressure.]

E. Test and obtain Architect's approval before painting, covering, or concealing piping, including swing joints.

3.5 SCHEDULES

A. Pipe Hanger Spacing:

PIPE SIZE		HANGER ROD MAX. HANGER SPACING		HANGER ROD DIAMETER	
Inches	(mm)	Feet	(m)	Inches	(mm)
1/2 to 1-1/4	12 to 32	6.5	2	3/8	9
1-1/2 to 2	38 to 50	10	3	3/8	9
2-1/2 to 3	62 to 75	10	3	1/2	13
4 to 6	100 to 150	10	3	5/8	15
8 to 12	200 to 300	14	4.25	7/8	22
14 and over	350 and over	20	6	1	25

END OF SECTION 232213

SECTION 232218 – STEAM AND CONDENSATE HEATING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Steam traps.

B. Steam air vents.

C. Strainers.

1.2 RELATED SECTIONS

A. Division 23 Section “HVAC Piping Insulation.”

B. Division 23 Section “Steam and Condensate Heating Piping.”

1.3 REFERENCES

A. ASME - Boiler and Pressure Vessel Codes, SEC 8-D - Rules for Construction of Pressure Vessels.

B. ASME B31.9 - Building Services Piping.

C. ASTM A105 - Forgings, Carbon Steel, for Piping Components.

D. ASTM A126 - Grey Iron Castings for Valves, Flanges, and Pipe Fittings.

E. ASTM A216 - Steel Casings, Carbon, Suitable for Fusion Welding, for High Temperature Service.

F. ASTM A395 - Ferric Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.

G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volt Maximum).

H. NFPA 70 - National Electrical Code.

1.4 SYSTEM DESCRIPTION

A. Follow these guidelines unless otherwise indicated.

B. Use Float and Thermostatic Traps for:
   1. Heating coils.
   2. Main headers.
   3. Branch lines.

1.5 PERFORMANCE REQUIREMENTS

A. Steam Traps:
   1. Select to handle minimum of two times maximum condensate load of apparatus served.
   2. Pressure Differentials:

a. Low Pressure Systems (5 psi (34 kPa) and less): 1/2 psi (3.4 kPa).
b. Low Pressure Systems (15 psi (103 kPa) maximum): 2 psi (13.8 kPa).
c. Medium Pressure Steam (25 psi (172 kPa) maximum): 5 psi (34 kPa).
d. Medium Pressure Steam (40 psi (276 kPa) maximum): 10 psi (69 kPa).
e. Medium Pressure Steam (60 psi (414 kPa) maximum): 15 psi (103 kPa).
f. High Pressure Steam (100 psi (689 kPa) maximum): 30 psi (206 kPa).
g. High Pressure Steam (150 psi (1034 kPa) maximum): 40 psi (276 kPa).

1.6 SUBMITTALS

A. Submit under provisions of Division 01 Section "Submittal Procedures."

B. Product Data:
1. Provide for manufactured products and assemblies required for this project.
2. Include product description, model, dimensions, component sizes, rough-in requirements, service sizes, and finishes.
3. Submit schedule indicating manufacturer, model number, size, location, rated capacity, load served, and features for each specialty.
4. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate application, selection, and hookup configuration. Include pipe and accessory elevations.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 01 Section "Operation and Maintenance Data."

B. Operation and Maintenance Data: Include installation instructions, servicing requirements, and recommended spare parts lists.

1.8 QUALITY ASSURANCE

A. Perform Work in accordance with State and Municipality standards for installation of boilers and pressure vessels.

B. Maintain one copy of each standards document on site.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years' documented experience.

1.10 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 code for installation of steam and steam condensate piping and specialties.

B. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose indicated.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division 01 Section "Product Requirements."

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.12 EXTRA MATERIALS

A. Furnish under provisions of Division 01 Section "Closeout Procedures."

B. Provide two service kits for each size and type of steam trap.

PART 2 - PRODUCTS

2.1 FLOAT AND THERMOSTATIC TRAPS

A. Manufacturers:
1. Spirax Sarco.
2. Armstrong International.
3. Barnes and Jones.
4. ITT Hoffman Specialty.

B. Trap:
1. Construction: ASTM A126 cast iron, [cast steel] or stainless steel body and bolted cover, stainless steel or bronze bellows type air vent, stainless steel float, stainless steel lever and valve assembly.
2. Rating: 125 psig (860 kPa) shell design pressure up to 450EF (232EC). Select operating differential pressure and orifice size as appropriate for system pressure.
3. Features: Access to internal parts without disturbing piping, bottom drain plug.
4. Accessories: [Gage glass with shut-off cocks]

2.2 STEAM AIR VENTS

A. 125 psig (860 kPa) WSP:
1. Manufacturers:
   a. Spirax Sarco.
   b. Armstrong International.
   c. ITT Hoffman Specialty.
2. Balanced Pressure Type: Cast brass body and cover; access to internal parts without disturbing piping; stainless steel bellows, stainless steel valve and seat.

B. 225 psig (1550 kPa) WSP:
   1. Manufacturers:
      a. Spirax Sarco.
      b. Armstrong International.
      c. ITT Hoffman Specialty.
   2. Balanced Pressure Type: ASTM A126 cast iron body and cover; access to internal parts without disturbing piping; phosphor bronze bellows, stainless steel valve and seat.

2.3 STEAM VACUUM BREAKERS

A. Manufacturers:
   1. Spirax Sarco.
   2. Armstrong International.
   3. ITT Hoffman Specialty.

B. Cast brass or stainless steel body and cover, stainless steel valve and seat; threaded inlet and outlet; access to inspect internal parts without disturbing piping; for 210 psig (1445 kPa) up to 500 degrees F (260 degrees C); venting 4 CFM (1.8 L/s) standard air at 6 in. Hg (20.3 kPa) vacuum.

2.4 STRAINERS

A. Manufacturers:
   1. Sarco.
   2. Armstrong.
   3. Barnes and Jones.
   4. Bell & Gossett.
   5. Flo-Fab.
   6. Muesco.
   7. Wheatley.

B. Size 2 inch (50 mm) and Under: Screwed brass or iron body for 175 psig (1200 kPa) working pressure, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.

C. Size 2-1/2 inch (65 mm) to 4 inch (100 mm): Flanged iron body for 175 psig (1200 kPa) working pressure, Y pattern with 3/64 inch (1.2 mm) stainless steel perforated screen.

D. Size 5 inch (125 mm) and Larger: Flanged iron body for 175 psig (1200 kPa) working pressure, basket pattern with 1/8 inch (3.2 mm) stainless steel perforated screen.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install specialties in accordance with manufacturer’s instructions.

B. Steam Traps:
   1. Provide minimum 3/4 inch size on steam mains and branches.
   2. Install with union or flanged connections at both ends.
   3. Provide gate valve and strainer at inlet, and gate valve [and check valve] at discharge
   4. Provide minimum 10 inch (250 mm) long, line size dirt pocket between apparatus and trap.

C. Remove thermostatic elements from steam traps during temporary and trial usage, and until system has been operated and dirt pockets cleaned of sediment and scale.

D. In high pressure and medium pressure mains, provide 3/4 inch (20 mm) nipple in bottom of main, extending 3/4 inch (20 mm) into and above bottom of pipe. Provide dirt pocket with 2 inch (13 mm) high pressure thermostatic trap.

END OF SECTION 232218

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SECTION 232300 – REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Moisture and Liquid Indicators.

D. Valves.

E. Strainers.

F. Check Valves.

G. Filter-Driers.

H. Expansion Valves.

I. Flexible Connections.

1.2 RELATED SECTIONS

A. Division 23 Section “Hangers and Supports for HVAC Piping and Equipment.”

B. Division 23 Section “HVAC Piping Insulation.”

C. Division 23 Section “Air-Cooled Refrigerant Condensers.”

D. Division 23 Section “Instrumentation and Control for Mechanical Systems.”

E. Division 26 “Electrical.”

1.3 REFERENCES

A. ARI 495 - Refrigerant Liquid Receivers.

B. ARI 710 - Liquid Line Dryers.

C. ARI 730 - Flow-Capacity Rating and Application of Suction-Line Filters and Filter-Driers

D. ARI 750 - Thermostatic Refrigerant Expansion Valves.

E. ARI 760 - Solenoid Valves for Use With Volatile Refrigerants.

F. ASHRAE 15 - Safety Code for Mechanical Refrigeration.

G. ASHRAE 34 - Number Designation of Refrigerants.

H. ASME - Boiler and Pressure Vessel Codes, SEC 9 - Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.

I. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

J. ASME B16.26 - Cast Copper Alloy Fittings For Flared Copper Tubes.

K. ASME B31.5 - Refrigeration Piping.

L. ASME B31.9 - Building Services Piping.

M. ASME SEC 8D - Boilers and Pressure Vessels Code, Rules for Construction of Pressure Vessels.

N. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

O. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

P. ASTM B88 - Seamless Copper Water Tube.

Q. ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

R. ASTM F708 - Design and Installation of Rigid Pipe Hangers.

S. AWS A5.8 - Brazing Filler Metal.

T. AWS D1.1 - Structural Welding Code, Steel.

U. UL 429 - Electrically Operated Valves.

1.4 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.

B. Liquid Indicators:
1. Use line size liquid indicators in main liquid line leaving condenser.
2. If receiver is provided, install in liquid line leaving receiver.
3. Use line size on leaving side of liquid solenoid valves.

C. Valves:
1. Use service valves on suction and discharge of compressors.
2. Use gauge taps at compressor inlet and outlet.
3. Use gauge taps at hot gas bypass regulators and at filters and filter driers, inlet and outlet.
4. Use check valves on compressor discharge.
5. Use check valves on condenser liquid lines on multiple condenser systems.

D. Refrigerant Charging (Packed Angle) Valve: Use in liquid line between receiver shut-off valve and expansion valve.

E. Strainers:
   1. Use line size strainer upstream of each automatic valve.
   2. Where multiple expansion valves with integral strainers are used, use single main liquid line strainer.
   3. On steel piping systems, use strainer in suction line.
   4. Use shut-off valve on each side of strainer.

F. Pressure Relief Valves: Use on ASME receivers and on compressors converted to higher pressure refrigerant. Pipe field-installed valves and valves furnished with equipment to outdoors as required by ASHRAE Standard 15 and where directed.

G. Permanent Filter-Driers:
   1. Use in low temperature systems.
   2. Use in systems utilizing hermetic compressors.
   3. Use filter-driers for each solenoid valve.

H. Replaceable Cartridge Filter-Driers:
   1. Use vertically in liquid line adjacent to receivers.
   2. Use with filter elements in suction line. Provide temporary wax removal filter-drier core in low temperature systems and systems where motor failure has occurred.
   3. Use filter-driers for each solenoid valve.

I. Solenoid Valves:
   1. Use in liquid line of systems operating with single pump-out or pump-down compressor control.
   2. Use in liquid line of single or multiple evaporator systems.
   3. Use in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into the suction line when system shuts down.

J. Receivers:
   1. Use on systems 5 tons (18 kW) and larger, sized to accommodate pump down charge.
   2. Use on systems with long piping runs.

K. Flexible Connectors: Utilize at or near compressors where piping configuration does not absorb vibration.

1.5 SUBMITTALS

A. Submit under provisions of Division 01 Section “Submittal Procedures.”

B. Shop Drawings: Indicate schematic layout of system, including equipment, critical dimensions, and sizes.

C. Product Data: Provide general assembly of specialties, including manufacturer’s catalog information. Provide manufacturer’s catalog data including load capacity.

D. Test Reports: Indicate results of leak test, acid test.

E. Manufacturer's Installation Instructions: Indicate support, connection requirements, and isolation for servicing.

F. Submit welders' certifications of compliance with AWS D1.1., and their assigned identification letters, numbers or symbols.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01.

B. Record exact locations of equipment and refrigeration accessories on record drawings.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 01.

B. Maintenance Data: Include instructions for changing cartridges, assembly views, spare parts lists.

1.8 QUALIFICATIONS

A. Installer: Company specializing in performing the work of this section with minimum three (3) years documented experience.

B. Design piping system under direct supervision of a Professional Engineer experienced in design of this work and licensed at the place where the Project is located.

1.9 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 for installation of piping system.

B. Welding Materials and Procedures: Conform to ASME SEC 9 and applicable state labor regulations.

C. Welders Certification: In accordance with AWS D1.1. and state and local requirements.

D. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

E. Refrigerant Safety: Conform with ASHRAE 15, state and local codes and manufacturer's requirements for safe handling to avoid exposure to workers or to occupants.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division 01 Section "Product Requirements."

B. Deliver and store piping and specialties in shipping containers with labeling in place.

C. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

D. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

1.11 MAINTENANCE MATERIALS

A. Provide maintenance materials under provisions of Division 01 Section “Closeout Procedures.”

B. Provide two refrigeration oil test kits, each containing everything required to conduct one test.

C. Provide two filter-dryer cartridges of each type.

PART 2 - PRODUCTS

2.1 PIPING

A. Copper Tubing: ASTM B280, Type ACR hard drawn, degreased, nitrogen charged and sealed. Annealed (soft) tubing may be used only for underfloor or below grade runs or for short (6 feet or less) above-grade connections to valves and equipment.
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints:
      a. Braze, 15 Percent silver for copper, brass, and bronze.
      b. Braze, 35 Percent silver, for brazing to ferrous metals (steel).
      c. Solder (for use only at equipment and valve connections where required by the equipment manufacturer).
      d. Other: If a valve or equipment manufacturer recommends a joint material other than those specified, submit it for approval.
      e. Flux: Use as recommended by alloy manufacturer. Should not be needed for copper-to-copper brazed joints.

B. Copper Tubing to 7/8 inch (22 mm) OD: ASTM B88, Type K, annealed.
   1. Fittings: ASME B16.26 cast copper.
   2. Joints: Flared.

C. Pipe Sleeves: Provide galvanized steel pipe sleeves for penetrations of walls, floors and roofs. Sleeves through non-fire-rated interior partitions shall be of G-90 coated galvanized steel sheet not less than 0.0217 inches (0.55 mm) thick (26 gauge).

D. Watertight Pipe Sleeves:
   1. Manufacturer: Thunderline Link-Seal.
   2. Sleeve: Segmented rubber seal with stainless steel tightening bolts. Provide suitable sleeve or core-drilled hole.

2.2 BRAZING MATERIALS – 15 Percent Silver

A. Manufacturers:
   1. Harris (Product: Stay-Silv 15).
   2. Lucas-Milhaupt (Product: Sil-Fos 15).
   3. Wolverine (Product: Silvaloy 15).
   4. No substitutions.

B. Nominal Composition: 5.0 percent phosphorus, 15.0 percent silver, 0.15 percent other elements (total), remainder copper. Cadmium-free.

C. Physical Properties:
   1. Color: Yellow/Gray
   2. Solidus: 1190 degrees F (643 degrees C)
   3. Liquidus: 1480 degrees F (802 degrees C)
   4. Brazing Range: 1300 – 1500 degrees F (704-816 degrees C)
   5. Electrical Conductivity: 9.9 percent IACS
   6. Electrical Resistivity: 17.40 Microhm-cm

D. Specification Compliance:
   1. ANSI/AWS A5.8, class BCuP-5
   2. ASME SFA5.8, class BCuP-5
   3. Optional:
      a. QQB 650C, class BCuP-5
      b. QQB 654A, class BCuP-5
      c. QQB 654, class BCuP-5

E. Flux:
   1. Harris (Stay-Silv For copper-to-brass joints. No flux required for copper-to-copper joints).

2.3 BRAZING MATERIALS – 35 percent Silver

A. Manufacturers:
   1. Harris (Product: Safety-Silv 35).
   2. Lucas-Milhaupt (Product: Braze 351).
   3. Wolverine (Product: Silvaloy A-35).
   4. No substitutions.

B. Nominal Composition: 35.0 percent silver, 33 percent Zinc, 0.15 percent other elements (total), remainder copper. Cadmium-free.

C. Physical Properties:
   1. Color: Yellow/Gray
   2. Solidus: 1250 degrees F (677 degrees C)
   3. Liquidus: 1410 degrees F (732 degrees C)
   4. Electrical Conductivity: 19.8 percent IACS
   5. Electrical Resistivity: 8.2 Microhm-cm

D. Specification Compliance:
   1. ANSI/AWS A5.8, class BAg-5
   2. ASME SFA5.8, class BCuP-5

E. Flux:
   1. Harris (Stay-Silv white flux, or where heating cycles are extended, Stay-Silv black flux).

2.4 SOLDER MATERIALS:

A. Manufacturers:
   1. Harris (Product: Stay-Brite).
   2. Lucas-Milhaupt (Product: Clean ‘n Brite).
   3. Wolverine (Product: Silvabrite).
   4. No substitutions.

B. Nominal Composition: Alloy of silver and tin (3-6 percent Ag, remainder Sn). Antimony-free.

C. Physical Properties:

1.	Color:	Bright Silver
2.	Solidus:	430 degrees F (221 degrees C)
3.	Liquidus:	430 degrees F (221degrees C)
4.	Electrical Conductivity:	16.4 percent IACS
5.	Shear Strength:	10,600 psi (73 MPa)
6.	Tensile Strength:	14,000 psi (96 MPa)
7.	Elongation:	48 percent

D. Specification Compliance:
1. NSF 51
2. ASTM B32-89, Alloy Grade Sn96
3. Federal Spec. QQ-S-571E, Class Sn 96 with exception to QPL paragraph 3.1
4. J-STD-006, Sn96Ag04A

E. Flux:
1. Harris (Product: Stay Clean Paste Flux, Stay Clean Liquid Flux (used with 4 inches or larger copper tubing also stainless steels), or Bridgit Water Soluble Paste Flux).
2. Canfield (Product: Aqua-Brite or AB Cream Flux). Glycerin-based, water soluble.

2.5 REFRIGERANTS AND LUBRICANTS

A. Refrigerant: ASHRAE 34;
1. R-410a: Blend of R-32/125. Suitable for new equipment.

B. Oils and Other Lubricants: Provide as required by the refrigerant manufacturer and the equipment manufacturer(s).

2.6 MOISTURE AND LIQUID INDICATORS

A. Manufacturers:
1. Sporlan Valve Co, Model ASee-All@.
2. Henry Valve Co.
3. Mueller.

B. Indicators: Double port type, UL listed, with steel body, flared or copper plated solder ends, leak proof fused sight glass, replaceable color coded paper moisture indicator and plastic cap; for maximum working pressure of 500 psig (3450 kPa) for connection sizes 1-1/8 inch (29 mm) O.D. and smaller, 430 psig (2960 kPa) for sizes 1-3/8 inch (35 mm) O.D. and larger, and maximum temperature of 200 degrees F (93 degrees C). Synthetic gaskets are not allowed.

2.7 VALVES

A. Diaphragm Packless Valves:
1. Manufacturers:
   a. Henry Valve Co.
   b. Mueller.
   c. Superior.
2. UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and

stainless steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, solder or flared ends, with positive backseating; for maximum working pressure of 500 psig (3450 kPa) and maximum temperature of 275 degrees F (135 degrees C).

B. Packed Angle Valves:
   1. Manufacturers:
      a. Henry Valve Co.
      b. Mueller.
      c. Superior.
   2. Forged brass (or brass and copper), forged brass seal caps with copper gasket, rising stem and seat with backseating, molded stem packing, solder or flared ends; for maximum working pressure of 500 psig (3450 kPa) and maximum temperature of 275 degrees F (135 degrees C).

C. Ball Valves:
   1. Manufacturers:
      a. Henry Valve Co.
      b. Mueller.
      c. Superior.
   2. Two piece forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psig (3450 kPa) and maximum temperature of 325 degrees F (163 degrees C).

D. Service Valves:
   1. Manufacturers:
      a. Henry Valve Co.
      b. Mueller.
      c. Superior.
   2. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psig (3450 kPa).

2.8 STRAINERS

A. Straight Line or Angle Line Type:
   1. Manufacturers:
      a. Henry Valve Co.
      b. Sporlan.
      c. Superior.

   2. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psig (2960 kPa).

B. Straight Line, Non-Cleanable Type:
   1. Manufacturers:
      a. Henry Valve Co.
      b. Mueller.
   2. Steel shell, copper plated fittings, stainless steel wire screen, for maximum working pressure of 430 psig (2960 kPa).

C. Screens: 80 mesh (0.007 in. (0.18 mm) square openings) in most uses, 60 mesh (0.010 in. (0.25 mm) square openings) in line sizes above 1-1/8 inch (29 mm), and 40 mesh (0.015 in. (0.38 mm) square openings) for use in suction lines.

2.9 CHECK VALVES

A. Globe Type:
   1. Manufacturers:
      a. Henry Valve Co.
      b. Mueller.
      c. Superior.
   2. Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc; for maximum working pressure of 500 psig (3450 kPa) and maximum temperature of 300 degrees F (149 degrees C).

B. Straight Through Type:
   1. Manufacturers:
      a. Henry Valve Co.
      b. Mueller.
      c. Superior.

C. Brass body and disc, phosphor-bronze or stainless steel spring, neoprene seat; for maximum working pressure of 500 psig (3450 kPa) and maximum temperature of 250 degrees F (121 degrees C).

2.10 FILTER-DRIERS

A. Replaceable Cartridge Angle Type:
   1. Manufacturers: Sporlan, Model CW Catch-All.
   2. Shell: ARI 710, UL listed, steel with epoxy paint finish, copper sweat fittings, removable cap with zinc-plated fasteners, for maximum working pressure of 500 psig (3450 kPa), size as recommended by manufacturer.
   3. Suction Filter Cartridge: Pleated media with integral end rings, stainless steel support, ARI 730 rating for capacity of the equipment served.
   4. Filter/Dryer Cartridge: Pleated media with solid core molecular sieve with activated alumina, ARI 730 rating for capacity of the equipment served.
   5. Wax Removal Cartridge: Molded bonded core of activated charcoal with integral gaskets, with filter surface area, desiccant volume and ARI 710 moisture rating as recommended by the manufacturer based on line size and refrigeration system horsepower (kW).

B. Permanent Straight Through Type:
   1. Manufacturers: Sporlan, Model CW Catch-All.
   2. ARI 710, UL listed, steel shell with copper plated steel sweat or flare fittings, molded molecular sieve/activated alumina desiccant filter core, for maximum working pressure of 500 psig (3450 kPa).
   3. Rating: ARI 730 flow capacity of the equipment served.

2.11 EXPANSION VALVES

A. Manufacturers:
   1. Sporlan.
   2. Henry Valve Co.
   3. Parker Hannifin.

B. Angle or Straight Through Type: ARI 750; balanced port or two-port design suitable for refrigerant, brass body, flare or solder connections, internal or external equalizer, resealable bleed hole, adjustable superheat setting, replaceable inlet strainer, with replaceable thermostatic power element with capillary tube and remote sensing bulb. Joints to the body at the removable power element and at the strainer shall be knife-edge type not requiring a synthetic seal.

C. Selection: Evaluate refrigerant pressure drop through system to determine available pressure drop across valve. Select valve for maximum load at design operating pressure and minimum 10 degrees F (6 degrees C) superheat. Select to avoid being undersized at full load and excessively oversized at part load. Select thermostatic charge for the particular application.

2.12 ELECTRONIC EXPANSION VALVES

A. Manufacturers:
   1. Sporlan.
   2. Henry Valve Co.
   3. Parker Hannifin.

B. Valve:
   1. Brass body with flared or solder connection, needle valve with floating needle and machined seat, stepper motor drive.
   2. Capacity: To meet the load of the equipment served.
   3. Electrical Characteristics: Compatible with the control system.

C. Evaporation Control System:
   1. Electronic microprocessor based unit in enclosed case, proportional integral control with adaptive superheat, maximum operating pressure function, preselection allowance for electrical defrost and hot gas bypass.
   2. Electrical Characteristics: Compatible with the control system.

D. Refrigeration System Control: Electronic microprocessor based unit in enclosed case, with proportional integral control of valve, on/off thermostat, air temperature alarm (high and low), solenoid valve control, liquid injection adaptive superheat control, maximum operating pressure function, night setback thermostat, timer for defrost control.

2.13 FLEXIBLE CONNECTORS

A. Manufacturers:
   1. Metraflex.
   2. Mason Industries.
   3. Keflex.

B. Corrugated bronze hose with single layer of exterior braiding, minimum 9 inches (230 mm) long with copper tube ends; for maximum working pressure 500 psig (3450 kPa).

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, parallel or perpendicular to building structure, and maintain gradient.

C. Install annealed piping free of kinks, and with bends only as necessary.

D. Install piping to conserve building space and not interfere with use of space.

E. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required.

H. Provide sleeves, sized to fit outside the pipe insulation with at least 1/4 inch clearance, at penetrations of building assemblies. Interrupt insulation where required by fire ratings. Extend floor sleeves to at least one inch above finished floor and seal watertight. For below-grade penetrations and where indicated, provide watertight link-seal pipe seals. Secure sleeves in place, and caulk, grout or firestop into the building assembly. Provide split chrome or painted escutcheons where exposed to occupancy.

I. Provide clearance for installation of insulation and access to valves and fittings.

J. Provide access to concealed valves and fittings.

K. Flood piping system with nitrogen when brazing.

L. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.

M. Prepare unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Division 09 Section “Painting.”

N. Insulate piping and equipment; refer to Division 23 Section “HVAC Piping Insulation”.

O. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.

P. Provide liquid line replaceable cartridge (unless sealed type is indicated) filter-driers, with isolation valves and valved bypass. On low temperature systems, or after a hermatic motor burnout, provide wax removal cores. Provide upstream and downstream pressure-testing access valves.

Q. Provide suction line replaceable cartridge filters, with isolation valves and valved bypass. Provide upstream and downstream pressure testing access valves. On low temperature systems, or after a hermetic motor burnout, provide temporary wax removal cores. After cleanup of the system, replace cores with filter elements for lower pressure drop.

R. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

S. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

T. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

U. Fully charge completed system with refrigerant after testing.

V. Provide electrical connection to solenoid valves. Refer to Division 26.

3.3 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Division 01 Section "Quality Requirements."

B. Test refrigeration system in accordance with ASME B31.5.

C. Pressure test system with dry nitrogen to 200 psig (1470 kPa). Perform final tests at 27 inches (92 kPa) vacuum and 200 psig (1470) kPa) using electronic leak detector. Test to no leakage.

D. Evacuate the system as required by Codes and by equipment manufacturer, including a vacuum test at 0.02 inches of mercury (500 microns). The system shall be valved off and tested for 2 hours with a pressure rise of no more than 0.002 inches of mercury (50 microns).

3.4 SYSTEM STARTUP

A. Lubricate motors and other moving parts as necessary before operating them.

B. Charge the system with liquid refrigerant into the low pressure side of the system, where the liquid will evaporate. Expel air from the system. Operate the compressor, condenser, water cooling pumps and evaporator fans during charging. Monitor compressor discharge pressure. Monitor oil levels for a period of 24 hours.

C. Coordinate control setpoints and wiring prior to startup.

D. Change suction filter elements if the pressure drop exceeds 1 Psi after the initial 24 hours of operation. Change suction wax removal cores to filter elements after system cleanup.

E. Adjust expansion valve superheat using a thermistor or thermocouple temperature sensor at the bulb location and a pressure gauge at the external equalizer line (or the compressor). Adjust under full system load, and again when the system stabilizes.

F. Check the system again after seven full days of operation.

G. Periodically clean strainers until no more accumulation occurs.

END OF SECTION 232300

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SECTION 232500 – HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cleaning of piping systems.

B. Chemical treatment.

1.2 RELATED SECTIONS

A. Division 23 Section “Instrumentation and Controls for Mechanical Systems.”

B. Division 26 “Electrical”: Electrical characteristics and wiring connections.

1.3 REFERENCES

A. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

A. Submit under provisions of Division 01 Section “Submittal Procedures.”

B. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.

C. Manufacturer's Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.

D. Submit certificate of compliance from authority having jurisdiction indicating approval of chemicals and their proposed disposal.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 01 Section “Operation and Maintenance Data.”

B. Operation and Maintenance Data: Include data on chemical feed pumps, agitators, and other equipment including spare parts lists, procedures, and treatment programs. Include step by step instructions on test procedures including target concentrations.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum 3 years’ experience. Company shall have local representatives with water analysis laboratories and full time service personnel.

B. Installer: Company specializing in performing the work of this Section with minimum 3 years’ experience and approved by manufacturer.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable code for addition of non-potable chemicals to building mechanical systems, and for discharge to public sewage systems.

B. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

1.8 MAINTENANCE SERVICE

A. Furnish service and maintenance of treatment systems for 1-year from Date of Substantial Completion.

B. Provide monthly technical service visits to perform field inspections and make water analysis on site. Detail findings in writing on proper practices, chemical treating requirements, and corrective actions needed. Submit 2 copies of field service report after each visit.

C. Provide laboratory and technical assistance services during this maintenance period.

D. Include 2-hour training course for Owner's operating personnel, instructing them on installation, care, maintenance, testing, and operation of water treatment systems. Schedule the course at Owner's convenience after start-up of systems.

E. Provide on-site inspections of equipment during scheduled or emergency shutdown to properly evaluate success of water treatment program, and make recommendations in writing based upon these inspections.

1.9 MAINTENANCE MATERIALS

A. Provide maintenance materials under provisions of Division 01 Section "Product Requirements."

B. Provide sufficient chemicals for treatment and testing during warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Chemical Treatment Systems Products, and Services:
   1. Nalco Company, Windham, ME office.

2.2 MATERIALS

A. System Cleaner:
   1. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products.
   2. Biocide; chlorine release agents such as sodium hypochlorite or calcium hypochlorite, or microbiocides such as quarternary ammonia compounds, tributyl tin oxide, methylene bis (thiocyanate), or isothiazolones.

B. Propylene Glycol: Provide 30% solution of inhibited propylene glycol and water for glycol hot water system.

2.3 BY-PASS (POT) FEEDER

A. Manufacturers:
1. Neptune Chemical Pump Co.: Model DBF-5HP.
2. General Treatment Products, Inc.: Model DB5-QC-AR.
3. Griswold Water Sytems: Model DB-5-GE-CS-Z-230.
4. Wheatley - a division of Global Flow Products: Model VFT-005-0.
5. No substitutions.

B. 5.0 gal (18.9 l), with quick opening cap (coarse threaded or Victaulic grooved coupling type), domed (convex) top and bottom, for working pressure of 200 psig (1370 kPa) at 200 degrees F (93 degrees C), fittings as required for piping configuration indicated on the Drawings, minimum of 3/4 inch (19 mm) FPT inlet, outlet, and bottom drain.

C. Provide fitting for air vent ball valve, either on the feeder or on piping, to allow release of pressure before opening the cap.

D. Plug any unused openings.

E. Open fill funnel is not desired. If a fill funnel is provided, provide a lockable ball valve, and padlock with 3 keys, to prevent tampering. If more than one lock is provided, they shall be keyed alike. Furnish keys to the Owner.

F. Install above the floor with legs or pedestal. For feeders which don't have integral legs or pedestal, provide additional support or concrete housekeeping pad.

2.4 TEST EQUIPMENT

A. Provide white enamel test cabinet with local and fluorescent light, capable of accommodating 4 – 10 ml zeroing titrating burettes and associated reagents.

B. Provide the Following Test Kits (verify suitability for the installed steam piping systems):
1. Alkalinity titration test kit.
2. Chloride titration test kit.
3. Sulphite titration test kit.
4. Total hardness titration test kit.
5. Low phosphate test kit.
6. Conductivity bridge, range 0 - 10,000 microhms.
7. Creosol red pH slide complete with reagent.
8. Portable electronic conductivity meter.
9. High nitrite test kit.

PART 3 - EXECUTION

3.1 PREPARATION

A. Systems shall be operational, filled, started, and vented prior to cleaning. Use water meter to

record capacity in each system.

B. Place terminal control valves in open position during cleaning.

C. Verify that electric power is available and of the correct characteristics.

3.2 CLEANING SEQUENCE

A. Concentration:
1. As recommended by manufacturer.
2. 1 pound per 100 gallons (1 kg per 1000 L) of water contained in the system.
3. 1 pound per 100 gallons (1 kg per 1000 L) of water for hot systems and 1 pound per 50 gallons (1 kg per 500 L) of water for cold systems.
4. Fill steam boilers only with cleaner and water.

B. Steam Systems:
1. Apply heat, slowly raising boiler temperature to 160 degrees F (71 degrees C) and maintain for 12 hours minimum.
2. Cool, then drain as quickly as possible.
3. Refill with clean water, drain, refill and check for sludge.
4. Repeat until system is free of sludge.
5. Apply heat to produce steam for piping system and maintain for 8 hours minimum. Bypass traps and waste condensate.

C. Use neutralizer agents on recommendation of system cleaner supplier and approval of Architect/Engineer.

D. Flush open systems and glycol filled closed systems with clean water for one hour minimum. Drain completely and refill.

E. Remove, clean, and replace strainer screens.

F. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.4 CLOSED SYSTEM TREATMENT

A. Provide one bypass feeder on glycol hot water system. Install isolating and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.

B. Introduce closed system treatment through bypass feeder when required or indicated by test.

END OF SECTION 232500

SECTION 233113 – METAL DUCTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Flexible Ductwork.

B. Metal Ductwork.

1.2 PERFORMANCE REQUIREMENTS

A. No variation of duct configuration or sizes is permitted except by written permission from the Architect. Size proposed substitutions of round ducts in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.3 SUBMITTALS

A. Submit under provisions of Division 01 Section “Submittal Procedures”.

B. Shop Drawings: Indicate duct fittings, particulars such as gauges, sizes, welds, and configuration. Submit prior to start of work.

C. Product Data: Provide data for duct materials, duct liner and duct connectors.

1.4 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01 Section “Closeout Procedures.”

B. Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Indicate additional fittings used.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA HVACDCS.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this Section with minimum 3 years’ experience.

B. Installer: Company specializing in performing the work of this Section with minimum 3 years’ experience.

1.7 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A and NFPA 90B standards.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures during and after installation of duct sealants.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Flexible Ducts:
   1. Flexible Technologies Group - Thermaflex product line.
   2. Buckley Associates - Flexmaster Triple-Lock Buck Duct product line.
   3. No substitutions.

B. Plastic Drawbands:
   1. Panduit.
   2. Thomas and Betts.
   3. Tyton.

C. Tape for Flexible Ducts:
   1. Ideal Tape Co., division of American Biltrite Inc.
   2. 3M Company.
   3. Nashua Tape Products, division of Berry Plastics Corp.
   4. Venture Tape Corporation.
   5. No substitutions.

D. Glass Fiber Reinforced Plastic Ducts:
   1. Spunstrand Inc.
   2. Perry Fiberglass Products Inc.

E. Manufactured Ductwork - Round and Flat Oval:
   1. McGill AirFlow LLC, a subsidiary of United McGill Corporation.
   2. Aero Heating & Ventilating, Inc.; Portland, ME.
   3. Air Purchases, Inc.; Manchester, NH – spiral duct lengths.
   4. Atlantic Air Products LLC; Bow, NH.
   5. Central City Sheet Metal; Brewer, Caribou, and Gorham, ME.
   6. Hahnel Brothers; Bangor and Lewiston, ME.
   7. Hranec Corporation; Uniontown, PA.
   8. Lindab, Inc. – duct fittings only.
   9. Monroe Metal Mfg. Inc.; Monroe, NC.
   10. Northeastern Sheet Metal Inc.; Goffstown, NH.
   11. Semco Inc., division of the Flakt Woods Group.
   12. S.G. Torrice Co.; Wilmington, MA – spiral duct lengths.
   13. Sheet Metal Connectors Inc.; Minneapolis, MN.
   14. Spiral Manufacturing Co. Inc.; Minneapolis, MN.
   15. Total Air Supply; Nashua, NH – spiral duct lengths.
   16. No substitutions.

F. Manufactured Ductwork - Transverse Duct Connection System:
   1. Ductmate.
   2. HFC Enterprises; Baldwin Park, CA – Dura Flange product line, for round and flat oval ducts only.

G. Sealants:
   1. Hardcast, a division of Carlisle Corporation.
   2. Approved equal.

2.2 MATERIALS

A. Galvanized Steel Ducts:
   1. Steel sheet metal components of galvanized ductwork in this Specification Section shall be galvanized steel sheet, lock-forming quality, having G60 or heavier zinc coating (G90 minimum for outdoor or moist applications) conforming to ASTM A653 rating system and tested in accordance with ASTM A90.
   2. Provide paint-grip exterior surfaces for exposed ducts, where available.
   3. Sheet metal gauge shall be not less than 26 gauge (0.56 mm).

2.3 FLEXIBLE DUCTS

A. Insulated Flexible Ducts:
   1. Semi-Rigid Flexible Aluminum Ductwork:
      a. Flexmaster Triple-Lock Buck Duct - Insulated.
      b. Triple lock mechanical joint aluminum flex duct, constructed entirely without the use of adhesive.
      c. Fiberglass insulation and fire-retardant polyethylene vapor retarder film.
      d. Pressure Rating: 12 inches WG (2988 Pa) positive for all sizes, 12 inches WG (2988 Pa) negative for sizes thru 16" diameter (406 mm), 8 inches WG (1992 pa) negative for sizes 18" (457 mm) and 20" (508 mm).
      e. Maximum Velocity: 5500 fpm (27.9 m/sec).
      f. Inside bend radius: Minimum one diameter.
      g. Temperature Range: -40ºF to 250ºF (-40ºC to 121ºC).
      h. UL 181, Class 0 air duct.
      i. Meets NFPA 90A and 90B standards.
   2. Fabric-Core Flexible Ductwork:
      a. Thermaflex Model M-KC.
      b. Greenguard certified.
      c. UL 181, Class 1, heavy fiberglass cloth fabric supported by helically wound spring steel wire; fiberglass insulation; reinforced metalized vapor barrier film.
      d. Pressure Rating: 10 inches WG (2.5 kPa) positive and 2.0 inches (500 Pa) negative.
      e. Maximum Velocity: 6000 fpm (30.4 m/sec).
      f. Temperature Range: -20ºF to 250ºF (-28ºC to 121ºC).

B. Non-Insulated Flexible Ducts:
   1. Semi-Rigid Flexible Aluminum Ductwork:
      a. Flexmaster Triple-Lock Buck Duct - Bare.

b. Triple lock mechanical joint aluminum flex duct, constructed entirely without the use of adhesive.
c. Pressure Rating: 12 inches WG (2988 Pa) positive for all sizes, 12 inches WG (2988 Pa) negative for sizes thru 16" diameter (406 mm), 8 inches WG (1992 pa) negative for sizes 18" (457 mm) and 20" (508 mm).
d. Maximum Velocity: 5500 fpm (27.9 m/sec).
e. Inside bend radius: Minimum one diameter.
f. Temperature Range: -40ºF to 250ºF (-40ºC to 121ºC).
g. UL 181, Class 0 air duct.
h. Meets NFPA 90A and 90B standards.

C. Return and Exhaust: Use either semi-rigid flexible aluminum type (insulated or bare), or fabric-core type (insulated). Non-insulated fabric-core type does not have adequate negative pressure rating.

2.4 ACCESSORIES

A. Drawbands for Flexible Ducts:
1. Stainless Steel: 1/2-inch (13 mm) wide with screw-driven worm gear.
2. Plastic: Panduit PLT5H or PLT8H; Thomas and Betts Dukt-Rap, VAL-26-50, or VAL-275X-25; or Tyton T150L or LX. Install with manufacturer's lever-action tightening tool.

B. Tape for Flexible Ducts: Ideal-Seal 587A/B, UL 181B-FX listed, aluminum foil with pressure-sensitive acrylic adhesive, -20ºF to 250ºF (-28ºC to 121ºC) temperature range, 25.0 lb/in. width (109.4 N/25.4 mm width) tensile strength.

C. Fasteners: Rivets, bolts, or sheet metal screws.

D. Sealants: See Duct Sealant portion of this Specification.

E. Hanger Rod: ASTM A36; galvanized steel; threaded both ends, threaded one end, or continuously threaded.

2.5 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVACDCS, as specified or as indicated on the drawings. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

B. SMACNA Duct Construction Manuals:
1. The SMACNA recommendations shall be considered as mandatory requirements.
2. Substitute the word "shall" for the word "should" in these manuals.
3. Where the Contract Specifications differ from SMACNA recommendations, the more stringent requirements (as determined by the Architect) shall take precedence.
4. Details on the Contract Drawings take precedence over SMACNA standards.

C. Sheet metal shall be galvanized steel as specified in Part 2 paragraph "Materials" in this Section, unless otherwise indicated or specified.

D. Construct Tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline.
   1. Where space is too restricted for full-radius elbows, provide mitered (square-throat) elbows with single wall turning vanes. Do not use air foil turning vanes.
   2. Mitered elbows in round or flat-oval ductwork shall be factory-manufactured.
   3. Radiused elbows with throat radius 1/2 times width of duct (centerline radius 1 width of duct) may be used instead of mitered elbows, but only where space is too restricted for full radius.
   4. Fittings not conforming to these requirements will be ordered removed and replaced with proper fittings.

E. Increase duct sizes gradually, not exceeding 15 degrees divergence or convergence (per side) wherever possible; maximum 30 degrees divergence (per side) upstream of equipment and 45 degrees convergence (per side) downstream.

F. Fabricate continuously welded round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints shall be minimum 4 inch (100 mm) cemented slip joint, brazed or electric welded. Prime coat welded joints.

G. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

H. Longitudinal locks or seams known as “button-punch-snap-lock” and other “snap-lock” types will not be permitted in rectangular duct. Snap-lock longitudinal seams may be used on round ducts up to 8 inches diameter, with screws provided to secure the seams at 24 inches on center maximum spacing.

I. Exposed Ducts: Select and handle materials with care for a neat appearance. Joint connections on round and flat oval ducts shall be sleeve or flanged type; drawbands are not acceptable.

2.6 MANUFACTURED DUCTWORK AND FITTINGS

A. Manufactured ductwork and fittings listed below are acceptable alternatives to standard ductwork systems. For exposed round and flat oval ductwork, factory-manufactured ductwork and fittings are required.

B. Manufacture in accordance with SMACNA HVACDCS, and as specified or as indicated on the drawings. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

C. Exposed Round and Flat Oval Ductwork: Shall be manufactured ductwork by one of the listed manufacturers.
   1. Spiral Ductwork Acceptable Products:
      a. McGill Airflow: Standard Uni-Seal product line (smooth surface between spiral lockseams) or Uni-Rib product line (one standing seam reinforcement between each pair of spiral lockseams).
      b. Monroe Metal Inc.: Standard spiral product line (smooth surface between spiral lockseams). V-Rib product line is not allowed.

c. Other Manufacturers: Standard spiral product line (smooth surface between spiral lockseams).
d. Ductwork and fittings shall be products of a single manufacturer.

D. Exposed Ducts:
1. Select and handle materials with care for a neat appearance.
2. Joint connections on round and flat oval ducts shall be sleeve or flanged type; drawbands are not acceptable. Joint connections on flat oval ducts 42 inches and wider shall be flanged type to ensure tight fit and good appearance.
3. Provide exterior reinforcing only where required, with prior approval from the Architect.
4. External reinforcement of flat-oval ducts shall be full-perimeter angle rings. Straight angles along flat sides only are not allowed.

E. Galvanized and stainless steel sheet metal used in fabrication shall be not less than 26 gauge thickness. Aluminum shall be not less than 0.025 in. nominal thickness. This requirement supersedes SMACNA requirements.

F. Round and Flat Oval Duct and Fittings:
1. Shall be suitable for at least 4 in. WG positive pressure and 2 in. WG negative pressure in accordance with SMACNA HVACDCS standards. This is a minimum; provide higher ratings where required.
2. Fittings shall be fabricated of sheet metal at least one gauge heavier than straight duct of the same size.
3. Fittings shall be factory-sealed so that no field sealing of joints between gores or segments is required. Acceptable methods of construction are fully welded, spot-welded with inner sealant, or standing-seam crimped joints.

G. Radiused Elbows in Round and Flat Oval:
1. In exposed ductwork shall be non-adjustable type, factory-sealed.
2. In concealed ductwork may be adjustable type, with full long radius as detailed on the Drawings. Short-radius elbows are not allowed.
3. Shall be constructed of the following minimum number of segments or gores: 90-degree: 4 gores; 60-degree: 3 gores; 45-degree: 3 gores; 30-degree: 2 gores; 22-1/2-degree: 2 gores.
4. 1-piece stamped elbows are acceptable up to 12 inches diameter. Pleated elbows are acceptable up to 10 inches diameter.

H. Mitered Elbows in Round and Flat Oval:
1. Available in both 90-degree and 45-degree elbows.
2. Shall have minimum number of welded single-wall vanes as follows (size is duct width in plane of bend):
a. 3 to 9 inch: 2.
b. 10 to 14 inch: 3.
c. 15 to 19 inch: 4.
d. 20 to 60 inch: 5.
e. Larger Sizes: 12-inch maximum spacing.

I. Inner tie-rod reinforcement is not allowed. Increase duct sheet metal gauge or external reinforcement as required.

J. Flat Oval Ducts: Machine made from round spiral lockseam duct.

K. Double Wall Insulated Flat Oval Ducts: Machine made from round spiral lockseam duct, galvanized steel outer wall, 1 inch (25 mm) thick fiberglass insulation, perforated galvanized steel inner wall; fittings manufactured with solid inner wall. Joint connections shall be flanged type; sleeve type or drawbands are not acceptable.

L. Transverse Duct Connection System: SMACNA "F" rated or SMACNA "J" rated rigidity class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips. Product shall be Ductmate factory-manufactured connectors, or field-formed flanges using a specialized machine.

2.7 PRESSURE CLASSIFICATION

A. Ratings as indicated on the Drawings or as specified. See Ductwork Pressure Class Schedule in Part 3 of this Section.

B. If no ratings are indicated, ductwork shall be rated for the external static pressure of the system plus twenty-five percent.
   1. If 4 dampers (of any type) or fewer can isolate a duct system, that portion of the system shall be rated for the shut-off pressure of the system fans.

2.8 DUCT SEALING

A. Seal ductwork as outlined in the SMACNA HVACDCS. Seal ductwork to a minimum of class A (transverse joints, longitudinal seams, and duct wall penetrations), regardless of pressure class

B. Seal ductwork systems as required to ensure that maximum duct leakage does not exceed that allowed by the latest edition of the SMACNA HVAC Air Duct Leakage Test Manual. Allow sealant to dry in accordance with manufacturer’s requirements of time and environmental conditions before ductwork systems are pressurized.

C. Existing Ductwork: Sealing of existing exhaust duct is not required.

D. Duct sealing materials used shall be non-flammable and non-combustible in both liquid and solid states.

E. Seal exposed ducts by applying mastic-type or gasket-type sealer just before the joint or seam is made; remove excess sealant for a neat appearance.

F. Fill (with matching duct material such as sheet metal) any gaps in duct which exceed the recommendations of the sealant manufacturer, and in no case shall liquid or mastic sealant be used to fill gaps or openings which exceed 1/8 inch (3.2 mm) in any direction. Verify that system air pressure acting on a wide gap will not exert enough force to damage or loosen the sealant.

G. Materials for Sealing:
   1. Hardcast: Flex-Grip 550 or Iron-Grip 601 mastic.
   2. Hardcast: gypsum-based tape and mastic, waterproof type when used on moist-air exhaust or in humid or outdoor locations.

3. Ductmate: Flanged lateral joints with gaskets.
4. Ductmate: PROseal.
5. Foster: Duct-Fas or Safetee mastic sealant. Duct-Fas is UV resistant and recommended for applications exposed to sunlight.
6. Mon-Eco: Eco-Duct Seal 4450 (red color) or 4452 (grey color). Use grey color where ducts will be unpainted and exposed to public view.
7. Polymer Adhesives Sealant Systems: Airseal No. 11 premium sealant.

2.9 UNIFORMITY OF MATERIALS

A. Ductwork accessories, including but not limited to volume dampers, smoke dampers, fire dampers, combination fire/smoke dampers, backdraft dampers and motorized dampers, shall be fabricated of materials that are similar to the ductwork in which they are installed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install ducts in accordance with SMACNA HVACDCS.

C. Duct Sizes are inside clear dimensions. For lined ducts, maintain sizes inside lining.

D. “Fishmouth” duct connections are not allowed.

E. Exposed Ducts:
1. Handle with care for a neat appearance. Repair or replace dented or damaged ductwork as required by the Architect. Select hangers for appearance, and to prevent sagging or distortion of duct.
2. Remove labels attached to ducts before receiving paint.

F. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

G. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

H. Use crimp joints with or without bead for joining round duct sizes 8 inch (200 mm) and smaller with crimp in direction of air flow.

I. Use double nuts and lock washers on threaded rod supports. Strap hangers shall be minimum 16-gauge (1.50 mm) x 1-inch (25 mm) galvanized straps. Hanger and support components including but not limited to “unistrut” shall be galvanized steel except that where other duct materials are used, the hanger materials shall be compatible and non-corrosive to the duct. Wire hangers are not acceptable.

J. Flexible Ducts:
   1. Connect diffusers or light troffer boots to low pressure supply ducts directly or with 5 feet (1.5 m) maximum length of flexible duct held in place with strap or clamp.
   2. Minimum bend radius shall be one and one half times the duct diameter. Support the bend to maintain this radius.
   3. Bends shall not exceed 45 degrees.
   4. Connect flexible ducts to metal ducts with 2 turns of duct tape and metal draw bands. Plastic drawbands may be used if they are installed using the band manufacturer's lever-action tightening tool. On insulated flexible ducts, provide an additional seal of tape and drawband on the insulation's vapor barrier.

K. Set plenum doors 6 to 12 inches (150 to 300 mm) above floor. Arrange door swings so that fan static pressure holds door in closed position.

L. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system. Do not start ducted air moving equipment until construction is completed to a stage where airborne construction dust is no longer present. At the time of substantial completion, the entire air distribution system shall be turned over to the Owner clear of construction dust and debris.

M. Install duct-mounted components furnished under other Sections of this Specification, such as smoke dampers, control dampers, control sensors, and smoke detectors. Install with straight lengths of duct as required for proper operation. Provide access at such components as required. Install in accessible locations for maintenance; notify the Architect if a location indicated or selected requires addition of access by other trades.

3.2 SCHEDULES

A. Ductwork Material Schedule

AIR SYSTEM	MATERIAL
Low Pressure Supply	Galvanized Steel
Return and Relief	Galvanized Steel
General Exhaust	Galvanized Steel

B. Ductwork Pressure Class Schedule

AIR SYSTEM	SMACNA PRESSURE CLASS
Supply	1 inch (250 Pa)
Return and Relief	1 inch (250 Pa)
General Exhaust	1 inch (250 Pa)

END OF SECTION 233113

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SECTION 233300 – AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Dampers:
   1. Volume Control Dampers.

B. Iris Dampers

C. Duct Access Doors.

D. Duct Sleeves, Prepared Openings and Closure Collars.

E. Duct Test Holes.

F. Flexible Duct Connections.

G. Turning Vanes.

1.2 SUBMITTALS

A. Submit under provisions of Division 01 Section “Submittal Procedures.”

B. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers, duct access doors and duct test holes.

C. Product Data: Provide for shop fabricated assemblies including volume control dampers, duct access doors, duct test holes and hardware used. Include electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Indicate for fire dampers.

1.3 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01 Section “Closeout Procedures.”

B. Record actual locations of access doors and test holes.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum 3 years’ experience.

1.5 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories Inc., as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division 01 Section "Product Requirements."

B. Protect dampers from damage to operating linkages and blades.

PART 2 - PRODUCTS

2.1 GALVANIZED STEEL

A. Steel sheet metal components of accessories in this Specification Section shall be galvanized steel sheet, lock-forming quality, having G60 or heavier zinc coating conforming to ASTM A653 rating system and tested in accordance with ASTM A90. Provide paint-grip exterior surfaces for exposed ducts, where available.

2.2 DAMPERS

A. MANUFACTURERS
1. Ruskin.
2. Air Balance, Inc.
3. Arrow.
4. Cesco.
5. Greenheck.
6. NCA.
7. Tamco.
8. Ventex.
9. Vent Products, Inc.
10. No substitutions.

B. Volume Control Dampers:
1. Factory-fabricate in accordance with SMACNA HVACDCS, and as specified or as indicated on the Drawings.
2. Shop fabrication is permitted for single blade dampers and splitter dampers only.
3. Height is the dimension perpendicular to the blade rod or shaft. Width is the dimension parallel to the blade rod.
4. Splitter Dampers:
   a) Material: Same gage as duct to 24 inches (600 mm) size in either direction, and two gages heavier for sizes over 24 inches (600 mm).
   b) Blade: Fabricate of double thickness sheet metal to streamline shape, secured with continuous hinge or rod.
   c) Operator: Minimum 1/4 inch (6 mm) diameter rod in self aligning, universal joint action, flanged bushing with set screw.
5. Single Blade Dampers: For duct sizes (height x width) up to 7 x 30 inch (175 x 760 mm). When height or width exceeds its respective maximum, provide multi-blade damper.
6. Multi-Blade Damper: Opposed blade pattern with maximum blade sizes (height x width) 8 x 72 inch (200 x 1825 mm). Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
7. End Bearings: Except in round ductwork 6 inches (150 mm) and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze

bearings. Provide retainer clips or other devices to prevent bearings from pulling out. For single-blade dampers, plastic bearings are allowed.

a) Manufacturers:
   1) Duro Dyne.
   2) Elgen Manufacturing.
   3) Rossi.
   4) Ventfabrics.

b) Snap-in Plastic Bearings for Single-Blade Dampers: Designed to push into hole in sheet metal, with retaining tabs. Flame Retardant, Glass Reinforced, "Zytel" polymer by Dupont, conforming to UL 1995 and UL 94 with the required flammability rating of 5VA or lower. Acceptable materials include Polyamide 66 (PA66) (glass-reinforced Dupont Zytel), nylon and acetyl. Submit manufacturer's verification of the suitability of these bearings for the application, including operating pressures and temperatures.

8. Quadrants:
   a) Manufacturers:
      1) Duro-Dyne.
      2) Elgen Manufacturing.
      3) Rossi
      4) Ventfabrics.
   b) Duro-Dyne Specline SR and SRH series; Quadline series; or Stampline dial regulators and wedge-loc regulators. Or equal by Elgen, Rossi, or Ventfabrics. Rossi Everlock regulators shall be acceptable equivalents to Duro-Dyne. Factory-manufactured dampers shall have damper manufacturer's choice of quadrant equal to the Duro-Dyne products specified.
   c) Provide locking, indicating quadrant regulators on single and multi-blade dampers and splitter dampers. Regulators shall include lever handle, locking wing nut and graduated indicator dial. Provide shaft seals, bushings, or gaskets for duct penetrations. Quadrants without these features are not allowed.
      1) Rossi Everlock Regulators: Locking lever handle of Polyamide 66 (PA66) (glass-reinforced Dupont Zytel) plastic, thumb trigger with stainless steel spring, with at least 9 latching positions in a 90-degree rotation.
   d) On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters, with open space to run insulation through.
   e) Where rod lengths exceed 30 inches (750 mm) provide regulator at both ends, with a single rod so that either regulator will control the entire damper.
9. Remote Manual Operators:
   a) Manufacturers:
      1) Young Regulator Company.
   b) Cable Type with Rack and Pinion: Bowden remote cable assembly, including rack and pinion controllers at damper and ceiling, galvanized angle bracket for duct mounting, stainless pull wire with galvanized steel flexible outer casing, and 2-5/8-in. (66 mm) diameter zinc cup with 3-in. (76 mm) diameter cover plate.
   c) Cable Type with Worm Gear Actuator: Model 1200-FS with worm gear operator for duct mounting, flexible shaft, and concealed ceiling cup and cover.
   d) Rigid Shaft Type with Worm Gear Actuator: 927 or 1200 series worm gear assembly, 301 or 315 series concealed ceiling regulator with cup and cap, and square connecting rod.
   e) Cover Plate Finish: Selected by Architect, from manufacturer's standard offerings including zinc plated, chrome plated, stainless steel, and primer painted.

10. Provide required operating wrenches for balancing, and furnish to the Owner at project completion.

2.3 IRIS DAMPERS

A. Manufacturers:
1. Ruskin - VFBD35 Series.
2. Continental Fan Manufacturing Inc. – Iris Series.
3. FanTech - IR Series.

B. Galvanized steel construction, full circumferential neoprene or EPDM seals to inlet and outlet ducts, 6 CFM (10.2 m^3/hr) maximum casing leakage, permanent plastic or metal pressure taps, accuracy +/-5%. Frame shall fully encapsulate iris blade segments, and have rolled edges for strength. Blade segments shall be internally linked to an adjustment knob or lever with calibrated position indicator. Internal linkage fully encapsulated out of the airstream. Linear response of airflow to damper position. Designed for low self-noise generation.

C. Blades open fully for duct cleaning. Full airtight closure capability is not required unless indicated on the Drawings.

D. Installation Note: For precise metering of airflow, the iris damper should be located at minimum 1 diameter before or after an elbow, 3 diameters before a tee, 1 diameter after a tee, and 3 diameters before an outlet register.

2.4 DUCT ACCESS DOORS

A. Manufacturers of Standard Doors:
1. Ruskin.
2. Air Balance, Inc.
3. Arrow.
4. Cesco.
5. DuctMate.
6. Greenheck.
7. NCA.
8. Vent Products, Inc.

B. Fabricated in accordance with SMACNA HVACDCS, and as specified or as indicated on the Drawings. Standard access doors and access doors for grease ducts may be shop-fabricated. Pressure rating shall be equal to the rating of the associated ductwork; see Part 3 Division 23 Section “Metal Ducts” for schedule of pressure classes.

C. Standard Doors: Removable, with retainer chain. Rigid and close-fitting with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum 1 inch (25 mm) thick insulation with galvanized steel sheet metal airstream-side cover.
1. 16 inches (406 mm) Square and Smaller: Secure with two sash locks.
2. Over 16 inches (406 mm), up to 24 inches (610 mm) Square: Provide four sash locks.
3. Larger Sizes: Hinges and two compression latches with outside and inside handles.
4. Clamping-type doors with knob handles, as manufactured by Ductmate, may be substituted for standard sizes.
5. Material: Galvanized steel in galvanized steel ductwork. Stainless steel in stainless steel ductwork. Aluminum as manufactured by Arrow in aluminum ductwork.

6. Provide in negative-pressure systems, and in positive-pressure systems with specified pressure class at or below 2 in. WG (498 Pa).

D. Access doors with sheet metal screw fasteners are not acceptable.

E. Sizing: Select sizes to allow testing, service, and maintenance within the ductwork. Such access may require the insertion of one or both hands, arms, and shoulders as appropriate. Doors sized for viewing-only are not acceptable. Doors found to be of inadequate size shall be replaced with proper size.

2.5 DUCT SLEEVES, PREPARED OPENINGS AND CLOSURE COLLARS

A. Duct Sleeves and Closure Collars: Fabricate from minimum 20-gage (1.0 mm) galvanized steel or equivalent thickness of aluminum, select material to match duct material. Where sleeves are installed in bearing walls, provide structural steel sleeves.

B. Prepared Openings: Provide 1-inch (25.4 mm) clearance between the duct and the sleeve.

2.6 DUCT TEST HOLES

A. Manufacturers:
1. Ductmate.
2. Carlyle Corporation.
3. Duro-Dyne.
4. Ventfabrics.

B. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

C. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.7 FLEXIBLE DUCT CONNECTIONS

A. Manufacturers:
1. Ductmate.
2. Ventfabrics.
3. Duro-Dyne.
4. No substitutions.

B. Fabricate in accordance with SMACNA HVACDCS, and as specified or as indicated on the Drawings.

C. Connector: Fabric crimped into metal edging strip.
1. Connectors shall be Ductmate PROFLEX Commercial series.
2. Fabric: UL listed coated woven glass fiber fabric meeting the requirements of NFPA 90A and NFPA 701. Resistant to weather and most chemicals, fat, grease, and oil.
a) Supply Ducts: Neoprene coated, minimum density 30 oz per sq yd (1.0 kg/sq m). Fire-retardant coating. Black color. Temperature range -40 to 200ºF (-40 to 93ºC).

b) Exhaust Ducts Serving Fume Hoods: Hypalon coated, minimum density 24 oz per sq yd (0.8 kg/sq m). Flame proof coating. White color. UV and ozone resistant. Temperature range -40 to 250ºF (-40 to 121ºC).

3. Net Fabric Width: Approximately 3 inches (75 mm) wide.
4. Metal: 3 inch (75 mm) wide, 24 gage (0.6 mm thick).
   a) Supply Ducts: G-60 galvanized steel.
   b) Exhaust Ducts Serving Fume Hoods: Type 316 stainless steel.
5. Connectors shall have double fold seams. Single fold seams (metal folded once only) shall not be accepted.

2.8 TURNING VANES

A. Manufacturers for Turning Vanes and Vane Rails:
   1. Ductmate Industries - PROrail 2-inch Turning Vane Rail.
   2. Duro Dyne - Junior Vane Rail.
   3. Hardcast, a division of Carlisle Corporation - Dyn-O-Rail Jr.

B. Factory-fabricated and factory-or-field-assembled units consisting of curved turning vanes for uniform air distribution and change of direction with minimum turbulence and pressure loss. Provide curved single thickness vanes for mitered elbows with change in direction of 45 degrees or greater, conforming to SMACNA HVACDCS single vane schedule for small vanes. Each vane shall form a 90-degree arc. Fill the entire duct cross-section with vanes. Orient leading edge of vanes parallel to the side of the duct (directed straight into the entering airstream). Turning vanes shall be minimum 16 gauge (1.61 mm), regardless of gauges that are recommended by SMACNA. Double thickness turning vanes are not allowed.

C. Turning vanes in rectangular ductwork and shop-fabricated round ductwork shall conform with details on the Drawings. If not detailed, the SMACNA detail for small-radius small-spacing single-thickness vanes shall be used.

D. Turning vanes in manufactured round and flat oval duct elbows shall be the duct manufacturer's standard size, spacing, and gauge, but must be single-wall and not less than 16 gauge (1.61 mm).

E. Factory-fabricated turning vane rails shall be a minimum of 24 gauge (0.7 mm) galvanized steel.

F. Material for vanes and rails shall be the same as the duct sheet metal.

2.9 UNIFORMITY OF MATERIALS

A. Ductwork accessories, including but not limited to volume dampers, smoke dampers, fire dampers, combination fire/smoke dampers, backdraft dampers and motorized dampers, shall be fabricated of materials that are similar to the ductwork in which they are installed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVACDCS. Refer to Division 23 Section "Metal Ducts" for duct construction and pressure class.

B. Provide duct access doors in horizontal return air, exhaust air and fresh air intake ductwork to facilitate the removal of accumulations of dust and combustible materials in accordance with NFPA 90A. Install access doors at maximum 20 foot (6 m) intervals and at the base of each vertical riser.

C. Provide duct access doors for inspection, servicing, and cleaning before filters, before and after coils, before and after fans, before automatic dampers, at fire dampers, at smoke dampers, at combination fire and smoke dampers, at smoke detector sampling tubes (upstream of the sampling tube), at multiple blade volume dampers, at backdraft and counterbalanced dampers, and elsewhere as specified or as indicated on the drawings.

D. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

E. Use splitter dampers only where indicated.

F. Provide balancing dampers on duct take-offs to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly. Where branch duct is completely above non-accessible wallboard ceiling and the Architect has not approved the use of access doors, duct mounted balancing dampers shall not be required.

G. For volume dampers located above suspended ceilings and in areas that are not visible to building occupants (e.g. mechanical rooms), provide fluorescent orange colored surveyor's tape. Permanently attach tape to damper handles and run tape down to 10 in. (254 mm) above ceiling or 12 in. (304 mm) below damper handle where ceilings do not exist (e.g. mechanical rooms).

H. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment, and support by vibration isolators. Staple and seal connections airtight.

I. Duct Sleeves and Prepared Openings: Install for ducts passing through roofs, ceilings, walls and floors. Field determine the proper size and location of sleeves and prepared openings.
   1. Duct Sleeves: Allow one-inch (25 mm) clearance between duct and sleeve or one-inch (25 mm) clearance between insulation and sleeve for insulated ducts, except at grilles, registers, and diffusers.
   2. Prepared Openings: Allow one-inch (25 mm) clearance between duct and opening or one-inch (25 mm) clearance between insulation and opening for insulated ducts, except at grilles, registers, and diffusers.

J. Closure Collars:
   1. Provide not less than 4 inches (100 mm) wide on each side of walls or floors where sleeves or prepared openings are installed. Fit collars snugly around ducts. Grind smooth edges of collar to prevent tearing or puncturing insulation covering or vapor barrier.
   2. Where insulated ducts penetrate non-fire-rated walls, insulation shall be continuous through the closure collars and the closure collars shall be installed tight to the insulation.
   3. Where insulated ducts penetrate fire rated walls, insulate ducts on both sides of closure collars and seal points of contact between closure collar and insulation with vapor proof adhesive.

4. Where ducts penetrate fire rated walls, provide fire proof sealant at closure collar. Refer to Division 07 Section "Through Penetration Firestop Systems," for fire proof sealant requirements.
5. Secure closure collars to ducts with sheet metal screws at maximum 6-inch (152 mm) centers and secure closure collars to walls or floors with sheetrock screws, nails or other appropriate fastener at maximum 6-inch (152 mm) centers.
6. Packing: Pack with non-combustible glass fiber insulation in spaces between sleeve/opening and duct/duct insulation. Cover or seal edges of packing to contain loose fibers.

K. Duct Hangers and Supports: SMACNA HVACDCS, Section 4. Hang ducts up to and including 36 inches (914 mm) in width by a minimum of 1 in x 16 gage (25 mm x 1.61 mm) flat straps on each side of the duct on 4 ft (1.22 m) centers, bent under bottom of duct a minimum of 2 inches (50 mm) and securely fastened to duct. Hang ducts larger than 36 inches (914 mm) in width by 3/8 inch (9.5 mm) steel rods and 2 x 2 x 1/4-inch (50x50x6.3 mm) steel angle trapeze hangers, spaced 4 ft (1.22 mm) on center. Provide seismic restraint complying with SMACNA SRMGMS. Anchor risers in the center of the vertical run to allow ends of riser free vertical movements. Attach supports only to structural framing members and concrete slabs. Do not anchor supports to metal decking unless a means is provided and approved for preventing the anchors from puncturing the metal decking. Where supports are required between structural framing member, provide suitable intermediate metal framing. Where C clamps are used, use retainer clips.
1. Flexible Ducts: Support ducts by hangers every 3 feet (0.9 m), unless supported by ceiling construction. Stretch flexible air ducts to smooth out corrugations, and long radius elbows, where possible, using a minimum length to make connections.
2. Flexible Connectors: Provide flexible connectors between fans and ducts or casings and where ducts are of dissimilar metals. For round ducts, securely fasten flexible connectors by zinc-coated steel clinch-type draw-bands. For rectangular ducts, lock flexible connectors to metal collars.
3. Ducts with Extra Weight Such As Lead Lining or Lagging: Include the extra weight in determination of suitable hangers and supports.

L. Provide duct test holes where indicated and required for testing and balancing purposes.

END OF SECTION 233300

SECTION 233400 – HVAC FANS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Centrifugal Fans:
   1. Backward Inclined Centrifugal Fans.
   2. Inline Centrifugal Fans.

B. Motors and Drives.

C. Fan Accessories.

1.2 RELATED SECTIONS

A. Division 23 Section “Duct Insulation.”

B. Division 23 Section “Metal Ducts.”

C. Division 23 Section “Instrumentation and Controls for Mechanical Systems”: Sequence of Operation.

D. Division 26 “Electrical.”

1.3 REFERENCES

A. Division 01 Section “Quality Requirements.”

B. ANSI/ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

C. ANSI/ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

D. AMCA 99 - Standards Handbook.

E. AMCA 210 - Laboratory Methods of Testing Fans for Rating.

F. AMCA 261 - Directory of Products Licensed to Use the AMCA Certified Ratings Seal.

G. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.

H. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

I. NEMA MG1 - Motors and Generators.

J. NFPA 70 - National Electrical Code.

K. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

L. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease Vapors from

1.4 SUBMITTALS

A. Division 01 Section “Submittal Procedures.”

B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

C. Shop Drawings: Indicate assembly of fans and accessories including fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

1.5 SUBMITTALS AT PROJECT CLOSEOUT

A. Division 01 Section “Closeout Procedures”: Procedures for submittals.

B. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this Section with minimum 3 years experience.

1.7 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.8 DELIVERY, STORAGE, AND PROTECTION

A. Division 01 Section “Product Requirements”: Transport, handle, store, and protect products.

B. Protect motors, shafts, and bearings from weather and construction dust.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Division 01 Section “Product Requirements”: Environmental conditions affecting products on site.

B. Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and fan has been test-run under observation.

PART 2 - PRODUCTS

2.1 ELECTRONICALLY-COMMUTATED (EC) MOTORS - ALSO KNOWN AS BRUSH-FREE DC (BFDC) MOTORS

A. Manufacturers:
   1. Greenheck Fan Corporation - “Vari-Green” motor.

2. General Electric.
3. Twin City Fan Co.

B. Applications: Centrifugal inline fans and centrifugal roof exhaust fans in sizes up to 3/4 hp (0.56 kW). Voltage 115V/1ph/60Hz.

C. Speed Control:
1. Typical motor speed range is 350 RPM to 1725 RPM.
2. Motor operates on a voltage signal of 2-10 VDC, with 15-20 percent speed at 2V and 100 percent speed at 10V. Motor is switched off when the signal is 0-1.9 VDC.
3. Control method furnished with the motor shall be one of the following, as indicated on the Drawings or in the Specifications:
   a. Motor-mounted potentiometer with screwdriver setting. Provide this unless otherwise indicated or specified.
   b. Remote-mounted Belimo potentiometer with calibrated 0-100 percent dial. Potentiometer includes a toggle switch to select an output range of 0-10V or 2-10V, so that with the 0-10 V setting the control can turn the fan off. Factory-mounted 24 VDC transformer in a junction box.
   c. Factory-furnished circuitry to accept a 0-10V signal from the building control system. Requires an additional 24 VDC power supply to the motor's controls, 0.70 VA capacity.
4. Provide field-furnished metal 2 x 4 in. (50 x 100 mm) junction box for mounting remote potentiometer dials.
5. Provide field-furnished interconnecting power and control wiring as required, including separate flexible conduits for line-voltage and low-voltage wiring.]

2.2 CENTRIFUGAL FANS

A. Manufacturers:
1. Greenheck.
2. Loren Cook.

B. Performance:
1. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.
2. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.
3. Fabrication: Conform to AMCA 99.
4. Performance Base: Sea level conditions.
5. Temperature Limit: Maximum 300 degrees F (150 degrees C)
6. Static and Dynamic Balance: Eliminate vibration or noise transmission to occupied areas.

C. Wheel and Inlet:

1. Backward Inclined: Steel construction with smooth curved inlet flange, heavy back plate, backwardly curved blades welded or riveted to flange and back plate; cast iron hub riveted to back plate and keyed to shaft with set screws.

D. Housing:
   1. Heavy gauge steel, spot welded for AMCA 99 Class I and II fans, and continuously welded for Class III, adequately braced, designed to minimize turbulence with spun inlet bell and shaped cut-off.
   2. Factory finish before assembly to manufacturer's standard.

E. Bearings and Drives:

   1. Bearings: Heavy duty pillow block type, self-aligning, grease-lubricated ball bearings, with ANSI/ABMA 9-rated L-50 life at 200,000 hours.
   2. Shafts: Hot rolled steel, ground and polished, with keyway, protectively coated with lubricating oil, and shaft guard.
   3. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 15 hp (11.2 Kw) and under, selected so required rpm is obtained with sheaves set at mid-position. Fixed sheave for 20 hp (15 Kw) and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.
   4. Belt Guard: Fabricate to SMACNA Standard; 0.106 inch (2.6 mm) thick, 3/4 inch (20 mm) diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

F. Accessories:
   1. Provide aluminum roof curb with wood nailer sized appropriately for each roof mounted supply fan. Roof curbs shall be 24” tall.

2.3 INLINE CENTRIFUGAL FANS

A. Manufacturers:
   1. Greenheck.
   2. Loren Cook.

B. Product Requirements:
   1. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.
   2. Sound Ratings: AMCA 301, tested to AMCA 300, and bear the AMCA Certified Sound Rating Seal.
   3. UL Compliance: Fan units shall be tested and approved by UL.

C. Inline Fans:
   1. Fan Unit: Direct drive inline centrifugal duct fan.
   2. Fan housing shall be constructed of heavy gauge galvanized steel with polyester/epoxy urethane powder coated finish. Internal air turning vanes shall be provided for maximum air performance.
   3. Fan shall be designed for 120 Volt, single phase, 60 Hz service. Provide externally mounted electrical terminal box with pre-wired terminal strip connections and disconnect switch.
   4. Motorized impeller shall be external rotor type with class B insulation, totally enclosed, with permanently sealed and lubricated ball bearings. Provide internal automatic reset thermal overload protection. Fan wheel shall be backward inclined airfoil type with an inlet venturi, statically and dynamically balanced as one integral unit. Motors shall be

rated for use in airstreams up to 140 degrees F (60 degrees C).

5. Fan shall be fully warranted for at least 5 years from the date of installation.

D. Accessories:
   1. Provide rubber isolation hangers to hang fan and/or surrounded ductwork.
   2. Provide two rubber isolated draw bands (clamps) for each fan to attach fan flanges to round ductwork. Clamps and isolation materials shall be suitable for use in 140 degrees F (60 degrees C) air stream.
   3. Provide heavy gauge mill finish aluminum triangular wall caps with integral aluminum backdraft damper as indicated on the Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Division 01 Section “Quality Requirements”: Manufacturer's instructions.

B. Install fans with resilient mountings and flexible electrical leads.

C. Install flexible connections between fan inlet and outlet and ductwork, including roof and wall-mounted fans unless otherwise indicated. Ensure metal bands of connectors are parallel with minimum 1 inch (25 mm) flex between ductwork and fan while running.

D. Secure roof fans with hex-head lag screws to roof curb, minimum of 2 screws on each side of fan, minimum 8 screws total. Screw threads shall be wood type or sheet metal type as appropriate, #12 (7/32 inch (5.6 mm) minimum sheet metal screw size, 3/16 inch (4.8 mm) shank minimum wood screw size. For aluminum fans with aluminum curbs, or steel curbs with wood nailers, use aluminum screws. For steel fans with steel curbs, use galvanized steel screws.

E. Secure wall fans with hex-head lag screws to wall structure, minimum of 2 screws on each side of fan, minimum 8 screws total. Screw threads shall be wood type or sheet metal type as appropriate, #12 (7/32 inch (5.6 mm) minimum sheet metal screw size, 3/16 inch (4.8 mm) shank minimum wood screw size. For aluminum fans, use galvanized steel screws with rubber or plastic washers to isolate dissimilar metals. For steel fans, use galvanized steel screws with galvanized steel washers.

F. Extend ducts to exhausters into roof curb. Transition ducts to roof curb opening size before penetrating roof.

   Hung Cabinet Fans:
   1. Install fans with resilient mountings and flexible electrical leads. Refer to Division 23 Section “Common Motor Requirements for HVAC Equipment.”
   2. Install flexible connections specified in Division 23 Section “Vibration and Seismic Controls for HVAC Piping and Equipment” between fan and ductwork. Ensure metal bands of connectors are parallel with minimum 1 inch (25 mm) flex between ductwork and fan while running.

G. Provide sheaves required for final air balance.

H. Install backdraft dampers on inlet to roof exhausters. Dampers shall be sized and installed in ductwork that is full roof curb opening size or full wall exhauster inlet size.

I. Where scheduled, provide backdraft dampers in ductwork on outlet from cabinet and ceiling exhauster fans and as indicated.

J. Do not operate fans in normal operation until ductwork is clean, filters are in place, bearings are lubricated, and fan has been test run under observation.

END OF SECTION 233400

SECTION 233700 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Diffusers.

B. Registers/Grilles.

C. Louvers.

1.2 SUBMITTALS

A. Submit under provisions of Division 01 Section “Submittal Procedures.”

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets indicating type, size, application, rated airflow, noise level, pressure drop, and throw distance as applicable. Submit both manufacturer’s standard performance tables and graphs, AND tabulated selection data specific to this project. NOTE: Submittals without complete and sufficient information, to verify the performance specified and scheduled on the Drawings, shall be rejected.

1.3 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01 Section “Closeout Procedures.”

B. Record actual locations of air outlets and inlets.

1.4 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ADC Equipment Test Code 1062 and ASHRAE 70.

B. Test and rate louver performance in accordance with AMCA 500.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this Section with minimum 3 years’ experience.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Diffusers, Registers, Grilles, and Drum Louvers:
   1. Titus.
   2. Anemostat.

3. Krueger.
4. Metalaire.
5. Price.

B. Louvers (Non-acoustical Type):
1. Greenheck.
2. American Warming and Ventilating.
3. Ruskin.

C. No substitutions.

2.2 RECTANGULAR CEILING DIFFUSERS

A. Type: Square and rectangular, multi-louvered directional diffuser to discharge air in pattern as indicated. Removable and interchangeable core for cleaning and changing patterns without tools.

B. Frame: Surface mount, inverted T-bar, snap-in, or spline type, as indicated and as required to be compatible with ceiling. In plaster ceilings, provide plaster frame and ceiling frame.

C. Fabrication: Steel with baked enamel off-white finish.

2.3 CEILING EXHAUST AND TRANSFER REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing, with blades set at 45 degrees, vertical or horizontal face as indicated.

B. Frame: 1-1/4 inch (32 mm) margin with concealed mounting.

C. Fabrication: Steel with 20 gauge (0.90 mm) minimum frames and 22 gauge (0.80 mm) minimum blades, steel and aluminum with 20 gauge (0.90 mm) minimum frame, or aluminum extrusions, as indicated, with factory off-white enamel finish.

2.4 SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing with spring or other device to set blades, vertical or horizontal face as indicated, double deflection.

B. Frame: 1-1/4 inch (32 mm) margin with concealed mounting and gasket.

C. Fabrication: Steel with 20 gauge (0.90 mm) minimum frames and 22 gauge (0.80 mm) minimum blades, steel and aluminum with 20 gauge (0.90 mm) minimum frame, or aluminum extrusions, as indicated, with factory off-white enamel finish.

2.5 WALL EXHAUST AND TRANSFER REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing, with blades set at 45 degrees, vertical or horizontal face as indicated.

B. Frame: 1-1/4 inch (32 mm) margin with concealed mounting.

C. Fabrication: Steel with 20 gauge (0.90 mm) minimum frames and 22 gauge (0.80 mm) minimum blades, steel and aluminum with 20 gauge (0.90 mm) minimum frame, or aluminum extrusions, as indicated, with factory off-white enamel finish.

2.6 LOUVERS (4-INCH)

A. Louvers shall be equal to, and shall have free areas no less than, Greenheck Model EDK-402. Acceptable substitutes by other listed manufacturers (subject to performance specified and scheduled on Drawings)

B. For reference, free area of a model EDK-402 in 48"x48" (1.2 m x 1.2 m) size is 8.49 sq. ft.

C. Free area velocity at beginning of water penetration shall be at least 930 fpm. Beginning of water penetration is defined by AMCA as 0.01 oz. per sq. ft (3 g/m2).

D. Air pressure drop for intake air at an air velocity of 1000 fpm (5.0 m/sec) in intake mode shall not exceed 0.20 in. wg (49.8 Pa).

E. Testing for water penetration and air performance shall be in accordance with AMCA Standard 511, using a 48"x48" (1.2 m x 1.2 m) louver.

F. Type: 4 inch (100 mm) deep with drainable blades on approximately 37 to 45 degree slope, heavy channel frame, removable expanded aluminum bird screen with 1/2 inch (13 mm) mesh mounted on interior face.

G. Fabrication: 0.081-inch (2.05 mm) thick 6063-T5 extruded aluminum alloy, welded assembly.

H. Mounting: Furnish with standard box frame and angles for installation.

I. Finish: Factory baked enamel. Submit manufacturer’s standard color chart. The Architect will select color. Accessories visible from outdoors or exposed to the airstream, such as interior and exterior screens, shall have finish identical to the louver.

J. Louvers shall bear the AMCA rating seal for water penetration and air performance.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

C. Install outlets and inlets to ductwork with air tight connection.

D. Slope ducts or plenums at louvers, and at brick or block vents, to drain outward, and seal bottoms watertight.

E. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

F. Surfaces exposed to view shall be clean, and free of stains, smudges, and scratches.

G. Provide hex-head fasteners to curb in each hole in curb caps or bases of roof-mounted units. Provide protection between dissimilar metals.

END OF SECTION 233700

SECTION 235100 - BREECHINGS, CHIMNEYS, AND STACKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Listed double-wall chimneys.

1.3 SUBMITTALS

A. Product Data: For the following:
   1. Building-heating-appliance chimneys.

B. Shop Drawings: For vents, breechings, chimneys, and stacks. Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, methods of field assembly, components, hangers and seismic restraints, and location and size of each field connection.
   2. For installed products indicated to comply with design loads, include calculations required for selecting seismic restraints and structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain listed system components through one source from a single manufacturer.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," for hangers and supports and AWS D9.1/D9.1M, "Sheet Metal Welding Code," for shop and field welding of joints and seams in vents, breechings, and stacks.

C. Certified Sizing Calculations: Manufacturer shall certify venting system sizing calculations.

1.5 COORDINATION

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of venting system that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, structural failures caused by expansion and contraction.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Ampco
   2. Metal Fab
   3. Selkirk Metalbestos
   4. Van-Packer
   5. Industrial Chimney

2.2 BREECHING AND CHIMNEY SYSTEM

A. The entire boiler breeching and chimney system shall be double wall with 2" insulation in cavity space. System shall be tested to UL 103, UL 641 and UL listed, for use with building heating equipment, in compliance with NFPA 211. Material shall comply with the following:

B. Boiler breeching and chimney components, supports and terminations shall be factory prefabricated, and shall be tested and listed by the Underwriters Laboratory, Inc., for use with building heating equipment burning gas, liquid or solid fuels as described in NFPA 211, Chapter 2.

C. The system shall maintain airtight integrity at pressures up to 72 inches of water column.

D. Inner walls shall be 20 gauge type 304 stainless steel. Outer walls shall be 24 gauge 304 stainless steel for portion of stack that is exposed above the roof and 24 gauge aluminum steel for the remainder of the breeching/stack system.

E. There shall be a 2" insulated space between the inner and outer walls. Insulation shall be 11 lb/cu.ft. minimum density fiber insulation.

F. The factory-built boiler breeching and chimney system shall be laboratory tested and listed by Underwriters Laboratories, for use with building heating equipment and appliances which produce exhausted flue gases at a temperature not exceeding 1000°F under continuous operating conditions and not exceeding 1400 F under intermittent operating conditions (see UL 103 Sections 17 and 18 respectively) when burning gaseous, solid or liquid fuels as described in NFPA 211. The breeching and chimney system shall be designed and installed to be gas tight and thus prevent leakage of combustion products into a building. The system shall be designed to compensate for all flue gas induced thermal expansions.

G. Inner pipe joints shall be sealed by use of factory supplied V bands and sealant as specified in the manufacturer's installation instructions.

H. The breeching and vent stack shall comply with national Safety Standards and all national and local building codes.

I. The entire breeching and chimney system from the boiler to the termination; including accessories, except as noted; shall be from one manufacturer.

J. The breeching and chimney system shall be installed according to the manufacturer's installation instructions and shall comply with the local codes or standards.

K. Chimney shall terminate at a height above the roof as indicated on drawings, with rain cap.

L. The chimney shall be self supporting, without the need for guy wires or intermediate supports, to a maximum of 12'-0" in height.

M. When installed according to the manufacturer's installation instructions, the breeching, chimney and its supporting system shall resist side loads (whether system is horizontal or vertical) at least 1.5 times the weight per foot of the piping. Plate supports shall support (as verified by manufacturer testing) 200 feet of vent stack in 6 inch through 20 inch ID sizes and 100 feet of vent stack in 24 inch ID and larger sizes with a factor of safety of at least four (4).

N. Technical Services Support: The factory-built modular breeching and chimney system shall be provided by a vendor organization which assures design, installation and services coordination.

O. The breeching and chimney shall be warranted against functional failure due to defects in material and manufacturer's workmanship for a period of ten years from date of delivery. The following two actions shall be performed by the Contractor:
   1. Drawings showing the actual layout and drawn to scale shall be provided by the manufacturer. The system shall be installed as designed by the manufacturer and in accordance with the terms of the manufacturer's 10 year warranty and in conjunction with sound engineering practice.
   2. The inner diameter for breeching and stack system shall be verified by the manufacturer's computations. The computation shall be technically sound, shall follow ASHRAE calculation methods, and incorporate the specific flow characteristics of the inner pipe. The contractor shall provide the exact boiler model and operating characteristics to the factory representative. Operating characteristics shall include flue gas flow rate, BTU, input, outlet temperature, local altitude, stack layout, and available external pressure at boiler outlet, etc., necessary to determine system operation at maximum and minimum levels of burner turndown range. Notify the engineer if the manufacturer's calculated inner diameter differs from that indicated.

P. Accessories, UL labeled:
   1. Ventilated Roof Thimble: Consists of roof penetration, vent flashing with spacers and storm collar.
   2. Bellows joint (lined) as required by manufacturer to compensate for linear thermal expansion.
   3. Stack Termination Rain Cap.
   4. Accessories as required by the manufacturer for manufacturer approved installation and support of system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATION

A. Listed, Refractory-Lined Metal Breechings and Chimneys: Freestanding boiler vents, oven vents, water heaters, exhaust for engines, fireplaces, and other solid-fuel-burning appliances.

3.3 INSTALLATION OF LISTED VENTS AND CHIMNEYS

A. Locate to comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.

B. Seal between sections of positive-pressure vents and grease exhaust ducts according to manufacturer's written installation instructions, using sealants recommended by manufacturer.

C. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.

D. Slope breechings down in direction of appliance, with condensate drain connection at lowest point piped to nearest drain.

E. Provide drain plug base cap with 1” NPT outlet. Provide 1” type L copper drain piping with deep trap and cleanouts. Pipe to nearest floor drain with air gap.

F. Lap joints in direction of flow.

G. Connect base section to foundation using anchor lugs of size and number recommended by manufacturer.

H. Join sections with acid-resistant joint cement to provide continuous joint and smooth interior finish.

I. Erect stacks plumb to finished tolerance of no more than 1 inch (25 mm) out of plumb from top to bottom.

3.4 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

B. Clean breechings internally, during and after installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth and apply touchup finish to match factory or shop finish.

C. Provide temporary closures at ends of breechings, chimneys, and stacks that are not completed or connected to equipment.

END OF SECTION 235100

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SECTION 235233 - STEEL FIRE-TUBE BOILERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Boilers.

B. Deaerator tank.

C. Controls and boiler trim.

D. Indoor/outdoor reset controller.

E. Steam and condensate connections.

F. Fuel burning system and connection.

G. Chimney connection.

1.2 RELATED SECTIONS

A. Division 03 Section “Cast-in-Place Concrete.”

B. Division 23 Section “Hydronic Specialties”

C. Division 23 Section “Steam and Condensate Heating Specialties.”

D. Division 26 “Electrical.”

1.3 REFERENCES

A. AGA - Directory of Certified Appliances and Accessories.

B. AGA Z21.13 - Gas-Fired Low-Pressure Steam and Hot Water Boilers.

C. ASME SEC 1 - Boiler and Pressure Vessel Codes - Rules for Construction of Power Boilers.

D. ASME SEC 4 - Boiler and Pressure Vessel Codes - Rules for Construction of Heating Boilers.

E. ASME SEC 8D - Boiler and Pressure Vessel Codes - Rules for Construction of Pressure Vessels.

F. HI (Hydronics Institute) - Testing and Rating Standard for Cast Iron and Steel Heating Boilers.

G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

H. NFPA 31 - Installation of Oil Burning Equipment.

I. NFPA 54 (AGA Z223.1) - National Fuel Gas Code.

J. NFPA 70 - National Electrical Code.

K. UL 726 - Oil-Fired Boiler Assemblies.

1.4 SUBMITTALS FOR REVIEW

A. Division 01 “Submittal Procedures”: Procedures for submittals.

B. Product Data: Provide data indicating general assembly, components, controls, safety controls, and wiring diagrams with electrical characteristics and connection requirements, and service connections.

C. Manufacturer's Field Reports: Indicate manufacturer’s specified performance and efficiency has been met or exceeded. Provide combustion test which shall include boiler firing rate, over fire draft, gas flow rate, heat input, burner manifold gas pressure, percent carbon monoxide (CO), percent oxygen (O), percent excess air, flue gas temperature at outlet, ambient temperature, net stack temperature, percent stack loss, percent combustion efficiency, and heat output.

D. Division 01 Section “Operation and Maintenance Data”: Include manufacturer's descriptive literature, operating instructions, cleaning procedures, replacement parts list, and maintenance and repair data.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this Section with minimum 3 years’ experience.

1.6 REGULATORY REQUIREMENTS

A. Conform to NFPA 70 and other applicable codes for internal wiring of factory wired equipment.

B. Conform to ASME SEC 4 and SEC 8D and AGA Z21.13, UL 726 for construction of boilers.

C. Units: AGA certified.

D. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Division 01 Section “Product Requirements”: Transport, handle, store, and protect products.

B. Protect boilers from damage by leaving factory inspection openings and shipping packaging in place until final installation.

PART 2 - PRODUCTS

2.1 BOILER MANUFACTURERS

A. Hurst (Basis of Design).

B. Approved Equal

2.2 BURNER MANUFACTURERS

A. Limpsfield LC Burner Series (Basis of Design).

B. Approved equal

2.3 DEAERATOR TANK

A. Hurst (Basis of Design).

B. Approved equal.

2.4 MANUFACTURED UNITS

A. Factory assembled, factory fire-tested, self-contained, readily transported unit ready for automatic operation except for connection of steam, fuel, electrical, and vent services. Boiler shall be 4-Pass Fire-Tube Wet-Back design with base rails to only extend along length of boiler shell. Boiler shall include factory mounted brackets welded to outside of shell for installation of access platform by others. Casing shall be factory cut around mounting brackets. Contractor shall coordinate closely with Manufacturer regarding placement of welded brackets prior to ordering equipment.

2.5 BOILER SHELL

A. Construct applicable ASME Boiler and Pressure Vessels Code for allowable working pressure of 150 psig steam. It is understood that operating pressure of boiler will be a maximum of 15 psig.

B. Provide lifting eyes on top of boiler.

C. Provide adequate tappings, observation ports, removable panels and access doors for entry, cleaning, and inspection.

D. Insulate casing with readily removable glass fiber blanket insulation covered by sectional performed sheet metal jacket.

E. Factory paint boiler, base, and other components with hard finish silicone enamel.

2.6 STEAM BOILER TRIM

A. Water Column: With cocks, gage glass set and blowdown valves for gage glass and column.
   1. Low water cut-off: Integral with water column with manual reset to automatically prevent burner operation whenever boiler water falls below safe level.
   2. Feedwater pump control: Integral with water column to automatically maintain water level by controlling pump operation.
   3. High water level alarm.
   4. Low-fire hold aquastat.
   5. Feed water inlet valves.
   6. Bottom and surface blow-down valves.
   7. Main steam stop/check valve.
   8. Steam header gate valve.
   9. Chemical feed quill.

10. Water sample cooler.

B. Auxiliary Low Water Cut-off: With drain valve to automatically prevent burner operation whenever boiler water falls below safe level and on failure of primary low water cut-off.

C. Steam Pressure Controls:
1. Auto reset type shall control burner firing rate to maintain steam pressure setting.
2. Manual reset type shall control burner to prevent steam pressure from exceeding safe system pressure.

D. ASME rated pressure relief valves.

E. Steam pressure gage with cock and test connection.

2.7 FUEL BURNING SYSTEM

A. Burner Assembly
1. Designed to fire both natural gas and #2 heating oil.
2. Split head gas injection.
3. Stainless steel diffuser and blast tube tip.
4. Aluminum gas control valve and stainless steel spillback valve with servo motor.
5. UV flame sensor.
6. Air damper assembly with servo motor.
7. Pressure atomizing oil lance and nozzle.
8. Oil valve train comprising of two oil valves.
9. Burner mounted terminal box.
10. Refractory burner throat.
11. Gas burner combustion results shall not exceed the following:
    a. 3% O2 throughout the entire firing range.
    b. <10 PPM CO throughout the entire firing range.
    c. 10.5% CO2 throughout the entire firing range.
12. #2 Oil burner combustion results shall not exceed the following:
    a. 4% O2 throughout the entire firing range.
    b. Smoke number of 1 or less.
    c. 13.5% CO2 throughout the entire firing range.

B. Combustion Air Fan
1. Sized for appropriate furnace pressure, finished to match burner.
2. Equipped with UL/UR Approved motor.

C. Gas Train (Pilot and Main Train)
1. Two pilot gas valves.
2. One pilot gas regulator.
3. One gas train double block valve.
4. One gas train high pressure regulator.
5. One low gas pressure switch.
6. One high gas pressure switch.
7. Two POC switches.
8. Valve proving system for main gas train.

D. Oil Pump Set Assembly
1. Individually sized oil pump.

2. Equipped with UL/UR Approved motor.
3. Suitably sized pressure regulator.

E. Ancillary Equipment
1. Air switch.
2. Steam pressure detector.
3. Air pressure sensor.
4. Gas pressure sensor.

F. Burner and all of its associated parts and controls shall be warrantied for a full two years (parts and labor) from the time of owner/engineer accepted factory start up.

2.8 CONTROL PANEL

A. Electronic combustion control to control ignition, starting and stopping of burner, and provide both pre-combustion purge and post combustion purge. Burner to shut down in event of ignition, pilot, or main flame failure. Interlock to shut down burner upon combustion air pressure drop. Non-programmable burner management system shall be UL Listed and FM approved, and shall be equal to Fireye YB110, Fireye YB230, Honeywell RM7800 or Honeywell EC7800.

B. Electronic detector to prevent primary fuel valves from opening until pilot flame is established.

C. Control system shall be Autoflame Micro Modulation MK7 or approved equal. Combustion control shall be accomplished using independent direct-coupled servomotors on the inlet air damper assembly and fuel valves so that no mechanical linkages are required. Include the following:
1. Fully linkage-less burner combustion control for maximum fuel-to-air ratio accuracy.
2. Support for variable speed blower control.
3. Panel mounted VFD to include RFI filters pre-wired to Autoflame Micro Modulation MK7 or approved equal.
4. Selectable pressure control for steam.
5. Draft control.
6. Oxygen trim control.
7. Configurable low fire hold and/or pressure setpoint ramping for thermal shock prevention on cold boiler startup.
8. Ability to switch fuel based upon a discrete switch input with indication lamp.
9. Up to 16 combustion curve steps to cover the range of modulation of the firing rate. Additional steps shall support burner pre-purge and ignition (light off).
10. Maintenance of combustion curve points upon loss of control system power.
11. Burner on/off push button.
12. Servo voltage transformer.
13. Mains voltage transformer.
14. Hand/Auto/Low flame hold switch.
15. System error/lockout push button
16. Output to starter for oil pumpset.

D. Control system shall provide options that allow the ability to:
1. Individually disable non-critical alarms, set the alarm threshold and adjust the onset delay.
2. Set a control to drive to a certain output level on failure of its sensor input.
3. Set limits for the control’s set point.

E. Control panel shall include a 12” full color graphical touch screen operator display.

F. Control system shall provide alarm and status indication and event recording with time and date stamp.

G. Control system shall be designed to accept and make use of the following measured signals under various combinations of options:
1. Remote setpoint for firing rate through plant master controller.
2. Steam pressure.
3. Water level.
4. Feedwater flow.
5. Combustion air temperature.
6. Stack temperature.
7. Stack oxygen percentage.
8. Natural gas pressure.
9. Natural gas flow.
10. #2 Fuel oil pressure.
11. #2 Fuel oil flow.
12. Combustion air flow.
13. Outdoor air temperature.
14. Blower speed feedback.
15. Air damper position feedback.
16. Gas control valve position feedback.
17. Oil control valve position feedback.

H. Control system shall also provide the accumulated total flow for the following measurements:
1. Natural gas flow.
2. Oil flow.

I. Controller shall communicate over an external network using high speed Ethernet up to at least 100 MB/sec.

J. Controller shall provide support for Modbus TCP/IP protocol which can be readily integrated with BMS, BAS or SCADA systems.

K. The controller shall not rely on proprietary communication protocols to communicate with other devices within the control system.

L. Provide Human Machine Interface (HMI) on UL/CE Approved floor mounted control panel. Floor mounted control panel to be located adjacent to boiler it serves.

2.9 ADDITIONAL REQUIRED BOILER ACCESSORIES

A. Provide supports welded to boiler shell for attachment to access platforms at top of boiler. Factory fabricate insulated casing with openings at locations of welded supports to provide a finished appearance. Provide close coordination

2.10 SOURCE QUALITY CONTROL

A. Provide factory tests to check construction, controls, and operation of unit. Tests will be witnessed by Architect/Engineer.

B. Provide authorized boiler inspection prior to shipment; submit copy of inspection report to Architect/Engineer.

2.11 DEAERATOR TANK

A. Hurst Oxy-Miser Series (or approved equal) to remove oxygen in boiler feedwater to 0.005 cc/liter.

B. Deaerator to include the following:
1. Welded steel tank designed and constructed to 50 PSIG as per the requirements of the ASME Code; deaerating section with spray valve.
2. Structural steel stand with square tubing and steel pump platform.
3. Feedwater pump and motor sets, Grundfos with integral VFD (or approved equal) with sizes and capacities as scheduled.
4. Water inlet valve assembly for condensate return and fresh water.
5. Overflow trap, tank thermometer, pressure gauge.
6. Steam pressure reducing valve assembly with temperature controller.
7. Safety relief valve(s), vent valves, tank drain valve.
8. Water gauge glass set with cocks, drain valve and protection rod.
9. Pump suction piping with strainer and shut off valve.
10. Control panel to automatically enable and alternate feedwater pumps and communicate to BAS via Modbus RS485 RTU.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install boilers level on concrete housekeeping base. Refer to structural plans for details.

B. Install in accordance with manufacturer's instructions.

C. Install in accordance with NFPA 54, NFPA 31.

D. Provide connection of natural gas and fuel oil service in accordance with NFPA 54 and NFPA 31.

E. Provide piping connections and accessories as indicated; refer to Division 23 Section Steam and Steam Condensate Heating Specialties."

F. Pipe relief valves through roof as indicated on plans.

G. Provide for connection to electrical service. Refer to Division 26 "Electric."

3.2 MANUFACTURER'S FIELD SERVICES

A. Provide 8 hours of onsite training with factory trained field representative for starting unit, training operator, and testing unit.

B. Provide 80 hours of on-call servicing to begin once successful factory startup is completed.

C. Manufacturer shall provide factory start up and calibration of all equipment provided under this section. A letter and start up report shall be provided by the manufacturer stating the results of the start up and that all systems are in proper working order. See section 230500, article, 1.16, A for additional start up requirements and documentation.

END OF SECTION 235233

SECTION 235700 – HEAT EXCHANGERS FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Brazed plate type heat exchangers.

B. Accessories and trim.

1.2 RELATED SECTIONS

A. Division 23 Section “Hydronic Piping.”

B. Division 23 Section “Hydronic Specialties.”

C. Division 23 Section “Steam and Condensate Heating Piping.”

D. Division 23 Section “Steam and Condensate Heating Specialties”

E. Division 23 Section “Instrumentation and Controls for Mechanical Systems.”

1.3 REFERENCES

A. ANSI/ASME - Boilers and Pressure Vessels Code.

1.4 REGULATORY REQUIREMENTS

A. Conform to Section 8D of the ANSI/ASME Boilers and Pressure Vessels Code for manufacture of tubular heat exchangers and heat exchanger shells.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this Section with minimum 3 years’ experience.

1.6 SUBMITTALS

A. Submit Shop Drawings and product data under provisions of Division 01 Section “Submittal Procedures.”

B. Indicate dimensions, locations, and size of tappings and performance data.

C. Submit manufacturer's installation instructions.

D. Submit design data in sufficient detail to verify that heat exchangers meet or exceed specified requirements.

E. Submit test reports of tube bundle pressure tests.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Division 01 Section “Operation and Maintenance Data.”

B. Include start up and shut down instructions, assembly drawings, and spare parts lists.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Division 01 Section “Product Requirements.”

B. Store and protect products under provisions of Division 01 Section “Product Requirements.”

C. Protect internals from entry of foreign material by temporary caps on flanged openings.

PART 2 - PRODUCTS

2.1 PLATE TYPE HEAT EXCHANGERS – BRAZED TYPE

A. Manufacturers:
1. Taco.
2. Armstrong.
3. Bell & Gossett.
4. APV.

B. Plates: Embossed with a specific heat transfer surface. Stainless steel Type 316.

C. Brazing Alloy: 99 percent copper.

D. Nozzles: Male NPT thread, stainless steel Type 316.

E. Mounting Studs: Threaded stainless steel Type 316, brazed or welded to outer plate.

F. Maximum Working Pressures and Temperatures:
1. Pressure: 435 psig (3000 kPa) (30 bar).
2. Temperature: 350 degrees F (176 degrees C).

G. U.L. Listed. (ASME Certified with permanent metal ASME stamp or nameplate.)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Support heat exchanger from structure above with spring isolation hangers.

C. Pitch shell to completely drain condensate.

D. Pipe relief valves to nearest floor drain.

E. Pipe drain valves to nearest floor drain.

3.2 STEAM TO WATER HEAT EXCHANGER TRIM

A. Shell: Pressure gauge tapping with pigtail siphon, vacuum breaker.

B. Water Inlet: Thermometer well, pressure gauge tapping, valved drain.

C. Water Outlet: Thermometer well for temperature regulator sensor, ASME rated pressure relief valve, thermometer well, pressure gauge tapping.

3.3 WATER TO WATER HEAT EXCHANGER TRIM

A. Water Inlets and Outlets: Thermometer wells, pressure gauge tappings.

B. Heated Water Outlet: Thermometer well for temperature regulator sensor, ASME rated pressure relief valve, valved drain.

END OF SECTION 235700

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SECTION 238126 – SPLIT-SYSTEM AIR CONDITIONERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Heat Pump Units.

B. Controls and Control Panels.

1.2 REFERENCES

A. ANSI/ASME - Boilers and Pressure Vessels Code.

B. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

C. ANSI/NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

D. UL - Underwriters' Laboratories.

E. NFPA 70 - National Electric Code.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Company specializing in manufacturing the Products specified in this Section with minimum 3 years experience.

B. Installer Qualifications: Company specializing in performing the work of this Section with minimum 3 years experience.

1.4 REGULATORY REQUIREMENTS

A. Conform to ANSI/NFPA 90A for the installation of Computer Room air conditioning units.

1.5 SUBMITTALS

A. Submit Shop Drawings and product data under provisions of Division 01 Section “Submittal Procedures.”

B. Submit product data for manufactured products and assemblies required for this project.

C. Indicate water, drain, electrical and refrigeration rough-in connections on Shop Drawings or product data.

D. Submit manufacturer's installation instructions under provisions of Division 01 Section “Submittal Procedures.”

1.6 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Division 01 Section “Operation and Maintenance Data.”

B. Include manufacturer's descriptive literature, operating instructions, installation instructions and maintenance and repair data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Panasonic (formerly known as Sanyo).

B. Daikin.

C. Fujitsu.

D. LG.

E. Mitsubishi.

F. Samsung.

2.2 GENERAL

A. The system to consist of a compact wall-mounted packaged evaporator section and matching air-cooled outdoor unit.

B. The units shall be listed by Electrical Testing Laboratories (ETL) and bear the ETL label.

C. Wiring shall be in accordance with the National Electrical Code (N.E.C.).

D. The units shall be rated in accordance with ARI Standard 210 and bear the ARI label.

E. A full charge of [R-410A] for refrigerant tubing shall be provided in the condensing unit. Tubing length shall be provided as required (coordinate with Drawings). A holding charge shall be provided in the evaporator.

F. Unit shall be U.L. approved and shall bear a U.L. label.

2.3 INDOOR UNIT

A. The indoor unit shall be completely factory assembled and wired.

B. The casing shall have a white finish.

C. The evaporator fan shall be a high performance, forward curve line flow fan direct driven by a single motor. The fan shall be statically and dynamically balanced and run on permanently lubricated bearings.

D. An adjustable change vane shall be provided with the ability to direct the air flow from horizontal to vertical. An adjustable guide vane shall be provided to manually change the air direction from left to right.

E. The evaporator coil shall be of nonferrous construction with smooth plate fins bonded to copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. Tube joints shall be brazed with phoscopper or silver alloy. The coils shall be pressure tested at the factory.

F. A condensate pan with drain shall be provided under the coil.

G. The unit shall be powered from the outdoor unit. See "Outdoor Unit" in this Section for more information.

H. The unit shall include washable filters.

2.4 OUTDOOR UNIT

A. The outdoor unit shall be completely factory assembled, piped, wired, and shall carry a complete refrigerant charge.

B. The casing shall be fabricated of galvanized steel, bonderized and finished with baked enamel.

C. The unit shall be furnished with a direct drive, propeller type fan arranged for horizontal discharge.

D. The motor shall have inherent protection, be of the permanently lubricated type and resiliently mounted for quiet operation.

E. The fan shall be provided with a raised wire guard to prevent contact with moving parts.

F. The compressor shall be of the high-performance serviceable rotary type with crankcase heater, accumulator and internal thermal overloads. The compressor shall be internally isolated with rubber mounts so as to avoid the transmission of vibration.

G. The condenser coil shall be of nonferrous construction with smooth plate fins bonded to copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. The coil shall be protected with an integral metal guard.

H. The unit shall be controlled by the microprocessor located in the matching indoor unit. The outdoor unit shall have the ability to provide power for the matching indoor unit. The unit electrical power shall be as scheduled on the Drawings.

I. Heat Pump Units: The unit shall include valves and controls for automatic changeover from cooling to heating mode.

2.5 SYSTEM CONTROL

A. The control system shall consist of two (2) microprocessors interconnected by a multi-wire cable. One microprocessor shall be factory wired and located within the indoor unit. It shall have the capability of sensing room temperature and indoor coil temperature; receive and process commands from the remote controller; and control the outdoor unit. Wireless remote controllers are not acceptable.

B. The microprocessor within the wall-mounted remote monitor and controller shall display setpoint and room temperature; provide two (2) manually selected modes of cooling, normal and economy operation at 2 degrees F (1 degrees C) above setpoint; provide continuous or

automatic start/stop of system operation; night setback operation of 4 degrees F (2 degrees C) above setpoint; and manual or automatic fan speed control. Automatic fan speed control shall be based upon the temperature difference between setpoint and room temperature maintaining lowest speed possible.

C. When heating capability is specified, the wall-mounted controller shall provide manually selected modes of heating, and night setback operation of 4 degrees F (2 degrees C) below setpoint.

2.6 REFRIGERANT PIPING

A. Unit shall be provided with pre-charged and pre-insulated line sets as recommended by the manufacturer.

2.7 WARRANTY

A. The units shall have a manufacturer's warranty for a period of 1 year from date of Substantial Completion.

B. The compressor shall have a warranty of 5 years from date of Substantial Completion.

C. If any part fails to function properly during the warranty period due to defects in workmanship or material, it shall be replaced or repaired.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that system is located per Drawings.

B. Verify that proper power supply is available.

3.2 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Mount rooftop air-cooled condensing units 24 in. (0.61 m) above the roof.

C. Mount ground-mounted air-cooled condensing units 24 in. (0.61 m) above grade.

D. Mount wall-mounted air-cooled condensing units using bracket furnished by the manufacturer, and provide supplemental supports as required.

E. Install condensing units so the fan blows in the same direction as the prevailing winds, unless otherwise directed by the manufacturer.

F. Provide recessed wall mounting box for mounting the wired indoor controller. Fasten the box to wall framing stud, masonry, or other suitable structural surface approved by the Architect; fastening to gypsum wallboard is not acceptable. Provide interconnecting low-voltage and line-voltage wiring and conduits, concealed unless otherwise indicated. Wall mounting box, wiring, and conduits shall be in accordance with the requirements of Division 26 – Electrical.

END OF SECTION 238126

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SECTION 238200 – CONVECTION HEATING UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Finned Tube Radiation.

B. Unit Heaters.

1.2 RELATED SECTIONS

A. Division 23 Section “Hydronic Piping.”

B. Division 23 Section “Hydronic Specialties.”

C. Division 23 Section “Instrumentation and Control for Mechanical Systems.”

D. Division 26 “Electrical”.

1.3 REFERENCES

A. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS FOR REVIEW

A. Division 01 Section “Submittal Procedures.”

B. Product Data: Provide typical catalog of information including arrangements.

C. Shop Drawings:
1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
2. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.
3. Indicate mechanical and electrical service locations and requirements.

1.5 SUBMITTALS AT PROJECT CLOSEOUT

A. Division 01 Section “Closeout Procedures”: Procedures for submittals.

B. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access or valving.

C. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owners name and registered with manufacturer.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings. Submit under provisions of Division 01.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

1.7 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 FINNED TUBE RADIATION

A. Manufacturers:
   1. Sterling.
   2. Vulcan.
   3. Slant-Fin.

B. Heating Elements: 1 inch (25 mm) ID steel piping, mechanically expanded into evenly spaced aluminum fins sized as scheduled.

C. Element Hangers: Quiet operating, ball bearing cradle type providing unrestricted longitudinal movement, on enclosure brackets.

D. Enclosures: 16 ga. steel up to 10.75 inches (450 mm) in height with easily jointed components for wall to wall installation. Support rigidly, on wall brackets at least 3 feet (1000 mm) on center maximum.

E. Finish: Factory applied baked enamel of color as selected.

F. Damper: Provide internal damper at enclosure air outlet.

G. Capacity: As scheduled, based on 65 degrees F (18 degrees C) entering air temperature, 170 degrees F average water temperature.

2.2 UNIT HEATERS

A. Manufacturers:
   1. Sterling Hydronics.
   2. McQuay.
   3. Price Industries.
   4. Trane.

B. Coils: Evenly spaced aluminum fins mechanically bonded to copper tubes, designed for 100 psi (1380 kPa) and 220 degrees F (104 degrees C).

C. Cabinet: 0.0598 inch (1.5 mm) steel with exposed corners and edges rounded.

D. Finish: Factory applied baked enamel of color as selected by the Architect on visible surfaces of enclosure or cabinet.

E. Fans: Axial fan, statically and dynamically balanced, direct driven.

F. Motor: Tap wound multiple speed permanent split capacitor or shaded pole with sleeve bearings, resiliently mounted.

G. Control: Multiple speed switch, factory wired, located in cabinet.

H. Configuration: Ceiling hung, horizontal discharge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install equipment exposed to finished areas after walls and ceiling are finished and painted. Avoid damage.

C. Protection: Provide finished cabinet units with protective covers during balance of construction.

D. Finned Tube Radiation: Locate on outside walls and run cover wall-to-wall unless otherwise indicated. Where drawings show elements located under windows, install with elements centered under windows. Install wall angles where units butt against walls.

E. Hydronic Units: Provide with shut-off valve on supply and lockshield balancing valve on return piping. If not easily accessible, extend vent to exterior surface of cabinet for easy servicing. For unit heaters, provide float operated automatic air vents with stop valve.

3.2 CLEANING

A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

END OF SECTION 238200

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SECTION 238216 - AIR COILS GENERAL

1.1 SECTION INCLUDES

A. Water Coils.

1.2 REFERENCES

A. ANSI/ARI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.

B. ANSI/NFPA 70 - National Electrical Code.

C. SMACNA - HVAC Duct Construction Standards, Metal and Flexible (HVACDCS).

D. ANSI/UL 1995 - Heating and Cooling Equipment.

E. ANSI/UL 1996 - Electric Duct Heaters.

1.3 SUBMITTALS

A. Submit under provisions of Division 01 Section “Submittals”. Indicate coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.

B. Submit manufacturer's installation instructions under provisions of Division 01 Section “Submittal Procedures”.

C. Submit manufacturer's certificate, under provisions of Division 01 Section “Quality Requirements”, that coils are tested and rated in accordance with ANSI/ARI 410.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum 3 years’ experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Division 01.

B. Store and protect products under provisions of Division 01.

C. Protect coil fins from crushing and bending by leaving in shipping cases until installation, and by storing indoors.

D. Protect coils from entry of dirt and debris with pipe caps or plugs.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Hydronic Coils:
   1. Equipment manufacturer.

2. Daikin Applied (formerly McQuay).
3. Trane.
4. USA Coil.
5. York.

2.2 FABRICATION – HYDRONIC COILS

A. Fins: Aluminum continuous plate type with full fin collars or individual helical finned tube type wound under tension.

B. Casing: Die formed channel frame of 16 ga (1.8 mm) galvanized steel with 3/8 inch (9.5 mm) mounting holes on 6 inch (150 mm) centers. Provide tube supports for coils longer than 36 inches (0.9 m).

2.3 WATER HEATING COILS

A. Headers: Cast iron with tubes expanded into header, seamless copper tube with silver brazed joints, or prime coated steel pipe with brazed joints.

B. Tubes: 5/8 inch (16 mm) OD seamless copper arranged in parallel or staggered pattern, expanded into fins, brazed joints.

C. Testing: Air test under water to 300 psig (2070 kPa) for working pressure of 200 psig (1380 kPa) and 220 degrees F (104 degrees C).

D. Configuration: Drainable, with threaded plugs for drain and vent; serpentine type with return bends on smaller sizes and return headers on larger sizes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in ducts and casings in accordance with SMACNA HVACDCS.

C. Support coil sections independent of piping on steel channel or double angle frames and secure to casings. Provide frames for a maximum of 3 coil sections. Arrange supports to avoid piercing drain pans.

D. Provide airtight seal between coil and duct or casing.

E. Protect coils to prevent damage to fins and flanges. Comb out bent fins.

F. Make connections to coils with unions and flanges.

G. Locate water supply at bottom of supply header and return water connection at top. Provide manual air vents at high points complete with stop valve. Ensure water coils are drainable and provide drain connection at low points.

H. On water heating coils, connect water supply to leaving air side of coil (counterflow arrangement).

I. Insulate headers located outside air flow as specified for piping.

END OF SECTION 238216

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SECTION 260010 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Basic Electrical Requirements specifically applicable to all Division 26 Sections.

B. Intent is to provide and install complete electrical systems, as required to accommodate the renovations to the existing building.

C. Access Panels: Where required by NFPA 70 (N.E.C.)

D. All cable bundles shall be limited to a maximum of 12 Cables, individual bundles of cables shall be separated by at least two (2) inches in all directions.

E. Seismic Requirements

1.2 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section. Examine all contract documents for requirements affecting the work.

1.3 DEFINITIONS

A. As used in this section, "provide" shall mean, "furnish and install". "Furnish" shall mean "to purchase and deliver to the project site complete with every necessary appurtenance and support", and "Install" shall mean "to unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project".

1.4 WORK BY OWNER

A. None.

1.5 SUBSTITUTIONS

A. Refer to Division 01 for Substitutions and Product Options.

1.6 ALTERNATES

A. Specified under Division 01 Section “Alternates”.

B. See Alternate #2 for deletion of type A8 and A1* lighting fixtures.

C. Coordinate related work and modify surrounding work as required.

1.7 REFERENCES

A. NEMA Standards.

B. NECA "Standard of Installation."

C. NFPA 70 (N.E.C.) latest edition.

D. NFPA 101 Life Safety Code.

E. U.L. Standards.

F. ANSI Standards.

G. Maine Uniform Building and Energy Codes (MUBEC) which include provisions of:
1. (IBC) International Building Code.
2. (IEBC) International Existing Building Code.
3. (IRC) International Residential Code.
4. (IECC) International Energy Conservation Code.
5. ASHRAE 62.1 Ventilation for Acceptable Indoor Air Quality.
6. ASHRAE 62.2 Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings.
7. ASHRAE 90.1 Energy Standard for Buildings except Low-Rise Residential Buildings.
8. ASTM E1465-06 Radon Standard for new residential construction - (Maine Model Standard).

1.8 SUBMITTALS

A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section “Submittal Procedures”.

B. Include products specified in Division 26 individual sections.

C. Submit Shop Drawings and product data grouped by individual Sections to include complete submittals of related systems, products, and accessories. Label each with Section number and title. Partial Section submittals will not be reviewed.

D. Include access panels.

E. Include fire-stop seals and fillers.

1.9 RECORD DRAWINGS

A. Submit under provisions of Division 01 Sections “Operation and Maintenance Data” and “Project Record Documents”.

B. Keep a marked set of Drawings at the site as a record set indicating all revisions in the work as the work progresses. At the completion of the work, mark the Drawings "As-Built Drawings" with the Contractor's name and date, and deliver to the Architect.

1.10 PERFORMANCE REQUIREMENTS

A. Conform to requirements of the latest edition of ANSI/NFPA 70 National Electrical Code (N.E.C.).

B. Conform to requirements of all local, State and Federal laws and regulations, plus local electric

utility company's rules, and the Fire Underwriters' requirements.

C. Furnish products listed and classified by Underwriters' Laboratories, Inc. (U.L.) as suitable for purpose specified and shown.

D. Secure and pay for all permits and certificates as required by local, State and Federal laws.

E. Request inspections from authority having jurisdiction.

F. Run separate circuits for lighting and receptacle outlets as indicated.
   1. Circuits shall be balanced and loads and capacities shall be in accordance with requirements of local electric light company and National Board of Fire Underwriters.
   2. Do not share neutral on branch circuits.

G. The entire electrical system shall be permanently and effectively grounded in accordance with Code requirements.

H. The Drawings indicate only diagrammatically the extent, layout and the general location and arrangement of equipment, conduit and wiring. Become familiar with all details of the work and verify all dimensions in the field so that the outlets and equipment will be properly located and readily accessible.
   1. Note that drawings do not show all junction boxes and fixture whips for lighting fixtures recessed in accessible ceilings. Although not specifically shown on the drawings, these fixtures shall be wired from junction boxes and 6'-0" unsupported whips. Provide number of junction boxes as required to allow for the 6'-0" whips. Wiring from fixture to fixture is not allowed. See Division 26 Section “Luminaires”.
   2. Lighting and Devices shown with same panel and circuit designation with no home run symbol may share same home runs to panelboards provided that the furthest device on the circuit does not exceed 2-1/2% voltage drop.
   3. Where home run symbols are shown, use separate run to panelboard for each symbol, and do not share home run with other devices having same panel and circuit designation.

1.11 PROJECT/SITE CONDITIONS

A. Coordinate with all other trades to ensure proper access and space requirements.

B. Where project conditions occur necessitating departures from the drawings, submit for approval the details of and reasons for departures prior to implementing any change.

C. Alterations
   1. Visit the site and become familiar with the existing conditions, and the requirements of the Plans and Specifications. No claim will be recognized for extra compensation due to failure of becoming familiar with the conditions and extent of the proposed work.
   2. Execute all alterations, additions, removals, relocations, or new work, etc., as indicated or required to provide a complete installation in accordance with the intent of the Drawings and Specifications.
   3. Repair or replace to the Owner's satisfaction, all existing work disturbed or damaged by the alterations.
   4. Except as specifically indicated, retain ownership and remove from site all existing materials, equipment, fixtures, wiring and devices disconnected and not reused; Pay all charges for proper disposal of materials:
      a. Materials specifically indicated to be returned to Owner.

b. Deliver to Owner: Lighting fixtures that are located in the boiler room.
c. Obtain receipt of delivery from Owner's Representative.

5. Do not reuse existing wiring except as specifically indicated. Existing conduit raceways may be reused, provided that the existing wires are removed and new wires are installed.
6. Provide finished blank plates on all existing recessed/flush ceiling and wall boxes which cannot be removed. All surface mounted conduits and boxes shall be completely removed.
7. Ensure all circuits in existing buildings are re-energized where existing panelboards are replaced, or existing wiring is rerouted, disconnected, or disturbed. Provide and install new wiring as required to meet this condition. Verify breaker/fuse sizes on existing circuits and do not load wiring to beyond 75% of their ampacities.

1.12 SEQUENCING AND SCHEDULING

A. Construct Work in sequence under provisions of Division 01 Section “Summary”.

B. Schedule and coordinate all work with Division 02, “Selective Structure Demolition and Alterations”. Schedule and coordinate all work with Division 31, 32, 33. Demolition and removal of electrical items are included as part of Division 26, including but not limited to existing building/s to be removed. Patching of existing structure left by removals is specified under Division 02.

C. Arrange to execute the work at such times and in such locations as may be required to provide uninterrupted services for the building, or any of its sections or portions of the Campus.
1. Services include but not limited to: Power, lighting, fire alarm, paging/intercom, telephone, computer, and life safety systems as required to maintain occupancy.
2. If necessary, install temporary work to provide for this condition. Authorization for interrupting services for any building or portions of the campus shall be obtained, in writing, from the Owner.
3. Costs for overtime work and temporary work shall be included in the bid.

1.13 TEMPORARY LIGHT AND POWER

A. Make arrangements to provide temporary power. Temporary Power shall be maintained through to substantial completion of project. Include power used for temporary trailers, tools, charging tools and powered lifts, testing and start-up of equipment. Provide generator back-up for all times that normal electrical service is not available. Minimum service size shall be 120/240V – 100A.

B. Furnish all temporary equipment, wiring, lamps, etc., as required for the completion of the work, including the work of all Subcontractors.

C. Temporary electrical work shall comply with OSHA and NEC requirements.

D. Lighting level in all areas for the duration of construction period shall be a minimum of 5 foot candles or per OSHA requirements, whichever is greater. Provide a minimum of 50 foot candles for taping and painting of all surfaces, and for surfaces receiving finishes, including flooring and tile. When permanent light fixtures are installed, these units may be used to provide required lighting level, but shall be re-lamped with correct lamps prior to building turnover to Owner."

PART 2 - PRODUCTS

2.1 PAINTING

A. Refer to Division 09 Section “Painting”.

2.2 ACCESS PANELS

A. Access panels required for items furnished under Division 26 shall be provided under this Division and installed under Divisions 08 and 09.

B. Standard panels: 12" x 16" except as indicated. Doors: flush type 14-gauge steel, hinged to 16-gauge frame. Latch: Flush face screw operated. All factory primed and painted to match in the field.
   1. Same U.L. fire rating as wall, floor, or ceiling in which they are installed.
   2. Equal To: Inryco/Milcor style "M" and Miami-Carey "HM".

2.3 VIBRATION ISOLATION MOUNT TYPES

A. Type DNP (Double Neoprene Pad)
   1. Neoprene pad isolators shall be formed by two layers of 1/4" to 5/16" thick ribbed or waffled neoprene, separated by a stainless steel or aluminum plate. These layers shall be permanently adhered together. The pads shall be sized so that they will be loaded within the manufacturer's recommended range.
   2. Type DNP isolators shall be formed from one of the following products or approved equal:
      Type NR.....Amber/Booth
      Type Korpad ..... Korfund Dynamics
      Type WSW..... Mason Industries
      Type NPS..... Kinetics Noise Control
      Series Shear Flex .....Vibration Mountings & Control

B. Type HN (Hanger Neoprene)
   1. Vibration isolation hangers shall consist of a neoprene-in-shear or glass fiber element contained in a steel housing. A neoprene neck bushing (or other element) shall be provided where the hanger rod passes through the hanger housing to prevent the rod from contacting the hanger housing. The diameter of the hole in the housing shall be sufficient to permit the hanger rod to swing through a 30° arc before contacting the hanger housing.

   2. Type HN isolators shall be one of the following products or approved equal:
      Type BRD-A .....Amber/Booth
      Type H ..... Korfund Dynamics
      Type HD ..... Mason Industries
      Type RH or FH ..... Kinetics Noise Control
      Type RHD or RFD.....Vibration Mountings & Control

PART 3 - EXECUTION

3.1 WORKMANSHIP AND INSTALLATION

A. Execute all work in a neat manner acceptable to the Local and State Electrical Inspector. Follow

manufacturer's installation recommendations.

B. All electrical components and their attachments shall be properly supported and where required shall be designed for seismic forces.

C. Lighting fixtures shall be supported from structural steel. Provide unistrut channels or equal to span between top cord of joists. See Division 26 “Luminaires”.

D. Perform all electrical work by licensed electricians well skilled in the trade and supervised by a Master Electrician.

E. Replace or repair to new condition, defective equipment and equipment damaged during installation or testing.

F. Transformers: Transformers within the building construction shall be mounted on Type DNP isolators. If the transformers are suspended, use Type HN isolators selected to achieve not less than 0.1" static deflection.

G. Dimmers: Dimmer cabinets shall be mounted on Type DNP isolators.

H. Isolation Mounts: All mounts shall be aligned squarely above or below mounting points for the supported equipment.

I. Position isolated electrical equipment so that it is free standing and does not come in rigid contact with the building structure or other systems.

3.2 TESTING AND ADJUSTING

A. The entire installation shall be free from short circuits and improper grounds. Test in the presence of the Architects or their representatives.

B. Test feeders with the feeders disconnected from the branch circuit panels.

C. Test each individual branch circuit at the panel. In testing for insulation resistance to ground, the power equipment shall be connected for proper operation. In no case shall the insulation resistance be less than that required by the National Electrical Code and the manufacturer's recommendations. Correct failure in a manner satisfactory to the Architect and Engineers.

D. Completely test and adjust each system specified under Division 26 for proper operation.

3.3 SLEEVES, INSERTS AND OPENINGS

A. Sleeves:
   1. Furnish and install all sleeves required for the work.
   2. Sleeves through exterior building walls or through concrete construction shall be rigid galvanized steel.
   3. Sleeves shall be sized to provide a total of not less than 1/2-inch clearance around conduit.
   4. Sleeves for setting into walls shall be flush with finished construction. Sleeves for setting into floor shall be embedded in concrete slab and extend approximately 2 inches above finished floors.
   5. All sleeved openings within building shall be sealed airtight using fire barrier caulking with a UL classification for use as a fire penetration seal for walls and floors with up to a

3-hour fire rating expanded.

6. Sleeves shall be provided in all locations where cables and conduits penetrate walls and floors.
7. Selection of firestopping materials and installation shall be in accordance with specifications Division 07 Section “Through Penetration Firestop Systems” for firestopping.

END OF SECTION 260010

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SECTION 260111 – CONDUIT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Metal Conduit.

B. Flexible Metal Conduit.

C. Liquidtight Flexible Metal Conduit.

D. Electrical Metallic Tubing (EMT).

E. Non-Metallic Conduit.

F. Flexible Nonmetallic Conduit.

G. Fittings and Conduit Bodies.

H. Innerduct - Non-Metallic Corrugated Flexible Raceway.

1.2 RELATED SECTIONS

A. Division 01 Section “Submittal Procedures”.

B. Division 07 Section “Through Penetration Firestop Systems.”

C. Division 26 Section “Basic Electrical Requirements”.

1.3 REFERENCES

A. NECA "Standard of Installation."

B. NEMA Standards.

C. NFPA 70 N.E.C. latest edition.

D. U.L. Standards.

1.4 DESIGN REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70 (N.E.C.)

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

C. Conduit Size: ANSI/NFPA 70 (N.E.C.) for conductors indicated. Increase size as required to include bonding conductors specified.

1.5 SUBMITTALS

A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section “Submittal Procedures”.

B. Include nonmetallic conduit (PVC) with associated fittings and describe intended use.

C. Include expansion fittings for all conduit types used on the project.

D. Include fire-stop seals and fillers.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01 Section “Operation and Maintenance Data” and “Project Record Documents”.

B. Accurately record actual routing of all underground and other conduits 2” and larger.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site under provisions of Division 01.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

D. Protect PVC conduit from sunlight.

1.8 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Verify routing and termination locations of conduit prior to rough-in.

C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to meet project conditions.

D. Where conduit routing is not shown, and destination only is indicated, determine exact routing and lengths required.

PART 2 - PRODUCTS

2.1 CONDUIT REQUIREMENTS

A. Except as otherwise specifically noted, all wiring throughout the building, including each of the systems specified, shall be enclosed in minimum size 3/4 inch conduit.

B. Underground Installations:
1. More than five feet from foundation wall: Use rigid galvanized steel conduit, and nonmetallic conduit PVC-40 encased in concrete where indicated.
2. Within two feet of pole base: Use rigid galvanized steel conduit.
3. Within five feet from foundation wall: Use rigid galvanized steel conduit, and nonmetallic

conduit PVC-40 encased in concrete.

4. In or Under Slab on Grade:
   a. Use rigid galvanized steel conduit and nonmetallic conduit PVC-40.
   b. Rise through slab in rigid galvanized steel conduit.
   c. Conduit larger than 3/4" shall run below slab.
5. Minimum Size: 3/4 inch.
6. Under paved areas: rigid galvanized steel conduit or concrete encased PVC-40.
7. Metallic conduits buried in soil: Coated with Bitumastic #50.
8. Communications (telephone, data, catv) service entrance conduits from riser pole to building: concrete encased PVC-40, concrete encased where indicated.

C. Outdoor Locations, Above Grade: Use rigid galvanized steel conduit.

D. In Slab Above Grade:
1. Use rigid galvanized steel conduit, intermediate metal conduit, electrical metallic tubing with water tight connectors.
2. Maximum Size Conduit in Slab: 3/4 inch.
3. Rise through slab in rigid galvanized steel conduit.

E. Interior Wet and Damp Locations: Use rigid galvanized steel conduit.

F. Dry Locations:
1. Concealed: Use rigid galvanized steel conduit, and electrical metallic tubing.
2. Concealed/ Accessible: Use rigid galvanized steel conduit and electrical metallic tubing.
3. Exposed: Use rigid galvanized steel conduit and electrical metallic tubing.
   a. Exposed conduit: Not allowed in finished areas except as specifically noted.
   b. Finished areas: Exposed raceways specified under Division 26 Section “Surface Raceways”.

G. Panel Feeders: Use rigid galvanized steel conduit, and electrical metallic tubing, PVC-40 in accordance with locations herein specified.

H. Couplings and connectors for electrical metallic tubing up to 2" shall be steel set screw or compression type. Set-screw connection shall be used for all tubing sizes with a minimum of four set-screws for coupling and two set-screws for connectors and fittings for sizes 1-1/4" and larger.

I. Couplings and connectors for rigid and intermediate metal conduit shall be threaded.

J. Termination for all conduit and tubing shall have insulated bushings or insulated throat connectors in accordance with code requirements.

K. Permanent Connection to Motors: Dry and damp or wet locations, use flexible liquidtight Type UA conduit with approved liquidtight fittings. Maximum length two feet (2').

L. Outside Plant Inner-duct: Non-Metallic Corrugated Flexible Raceway designed for use within a conduit. Duct shall maintain flexibility at low temperatures and shall contain pre-installed pull string.
1. Carlon Optic-Gard/PE or equal for sizes 1" and 1.25"ID.
2. Carlon corrugated P&C Flex PVC for sizes 1.5" to 4"ID designed for direct burial but installed in conduits where shown.

M. Inside Plant Inner-duct: Premises Non-Metallic Corrugated Flexible Raceway designed for use within and without a conduit. Duct shall contain pre-installed pull string.
   1. Carlon Plenum-Gard or equal for sizes 3/4" to 2"ID. Use where plenum cable is required and where indicated.
   2. Carlon Riser-Gard or equal for sizes 3/4" to 2"ID. Use where riser cable is required and where indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. In general, all raceways shall be concealed above ceilings and within finished walls - securely supported in accordance with code requirements. Wiring in areas with no finished ceilings (exposed construction) shall be exposed overhead such that all raceways are parallel or perpendicular to joists, columns or beams and all drops to wall devices shall be concealed in walls.

B. Install exposed only where specifically indicated.

C. Install conduit in accordance with NECA "Standard of Installation."

D. Install nonmetallic conduit in accordance with manufacturer's instructions.

E. Arrange supports to prevent misalignment during wiring installation.

F. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

G. Group Related Conduits:
   1. Support using conduit rack of Power-Strut, or approved equal.
   2. Parallel runs shall be neatly clustered with all bends and offsets of uniform pattern
   3. Provide space on each for 25 percent additional conduit.

H. Substantially support with approved clips or hangers spaced not to exceed ten feet (10') on centers except 1/2" rigid conduit and 1/2" and 3/4" electrical metallic tubing shall have supports spaced not to exceed six feet (6').

I. Fasten conduit supports to building structure.
   1. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
   2. Do not attach conduit to ceiling support wires.
   3. Conduits larger than 2” shall be supported from top cord of joists.

J. Arrange conduit to maintain headroom and present neat appearance.

K. Route conduit parallel and perpendicular to walls.

L. Route conduit in and under slab from point-to-point.
   1. Install only where specifically indicated or required.
   2. Obtain approval from the Architect before installation.

M. Do not cross conduits in slab.

N. Maintain adequate clearance between conduit and piping.

O. Maintain 6 inch clearance between conduit and surfaces with temperatures exceeding 104ºF.

P. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

Q. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

R. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction. Use factory elbows or hydraulic one-shot bender to fabricate bends in metal conduit 2 inches or larger in size.

S. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

T. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control and expansion joints.

U. Provide suitable labeled nylon pull string in each empty conduit.

V. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

W. Use sleeves when passing through floors and walls.

X. When serving roof top equipment, conduit shall enter within the weather-proof curbing. Maintain water tight roofing system.

Y. Ground and bond conduit under provisions of Division 26 Section “Grounding and Bonding.”

Z. Identify conduit under provisions of Division 26 Section “Electrical Identification.”

AA. All elbows in nonmetallic conduit runs shall be rigid galvanized steel to eliminate "burn through" when pulling in conductors.

3.2 FIELD QUALITY CONTROL

A. No wire shall be installed until work which might cause damage to wires or conduits has been completed.

B. Conduits shall be thoroughly cleaned of water or other foreign matter before wire is installed.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire-resistance rating of partitions and other elements, using approved seals, fillers and materials.

END OF SECTION 260111

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SECTION 260123 - WIRE AND CABLE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Building wire and cable.

B. Metal clad cable.

C. Wiring connectors and connections.

1.2 RELATED SECTIONS

A. Division 26 Section 260010 “Basic Electrical Requirements.”

B. Division 26 Section 260111 “Conduit.”

C. Division 26 Section 260112 “Surface Raceways.”

D. Division 26 Section 260130 “Boxes.”

E. Division 26 Section 260195 “Electrical Identification.”

1.3 REFERENCES

A. NEMA Standards.

B. NFPA 70 N.E.C. Latest Edition.

C. U.L. Standards.

1.4 DESIGN REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70. (N.E.C.)

B. Furnish products listed and classified by Underwriters' Laboratories, Inc. as suitable for purpose specified and shown.

C. Conductor sizes shown are based on copper:

D. Manufacturer's name, wire size and insulation type shall be clearly marked on the insulation or jacket.

1.5 SUBMITTALS

A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section “Submittal Procedures.”

B. Include MC manufacturer’s specification sheets indicating construction, diameter, ampacity and bending radius.

1.6 PROJECT CONDITIONS

A. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet project conditions.

B. Where wire and cable routing is not shown, and destination or circuit number only is indicated, determine exact routing and lengths required.

1.7 COORDINATION

A. Locate such that outlets are readily accessible.

B. Determine required separation between cable and other work.

C. Determine cable routing to avoid interference with other work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. General Cable.

B. Triangle PWC, Inc.

C. Superior Essex Inc.

D. Southwire Company.

E. Allied Wire & Cable.

F. Cerro Wire.

G. AFC Cable Systems.

H. Encore Wire Corporation.

I. United Copper Industries.

2.2 WIRE AND CABLE

A. Description: Single conductor insulated wire.

B. Conductors: Copper.

C. Insulation Voltage Rating: 600 volts.

D. Insulation: ANSI/NFPA 70 (N.E.C.), Type THHN/THWN, XHHW, rated 90° C.

2.3 METAL CLAD CABLE

A. Description: ANSI/NFPA 70 (N.E.C.), Type MC with separate insulated ground.

B. Conductor: Copper, maximum # 10 AWG.

C. Insulation Voltage Rating: 600 volts.

D. Insulation Temperature Rating: 90ºC.

E. Armor Material: Steel or Aluminum.

F. Armor Design: Interlocked Metal Armor

G. Jacket: None.

2.4 WIRING CONNECTORS

A. Use the Following Types As Herein Specified:
1. Split bolt connectors.
2. Solderless pressure connectors.
3. Spring wire connectors.
4. Compression connectors.
5. Insulation piercing connectors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that mechanical work likely to damage wire and cable has been completed.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.3 WIRING METHODS

A. Concealed Dry Interior Locations: Use only wire Type THHN/THWN, and XHHW insulation, in raceway or metal clad cable.

B. Accessible Dry Interior Locations (such as above acoustical ceilings): Use only wire Type THHN/THWN, and XHHW insulation, in raceway or metal clad cable.

C. Exposed Dry Interior Locations:
1. Use exposed wiring only where specifically indicated.
2. Use only building wire Type THHN/THWN, and XHHW insulation, in raceway.

D. Wet or Damp Interior Locations: Use only building wire Type THHN/THWN, XHHW, and XHHW-2 insulation, in raceway.

E. Exterior Locations: Use only building wire Type THHN/THWN, XHHW, and XHHW-2 insulation, in raceway.

F. Underground Installations: Use only building wire Type THHN/THWN, XHHW, and XHHW-2 insulation installed in raceway.

G. Panel Feeders: Use only building wire Type THHN/THWN, XHHW, and XHHW-2 insulation, in raceway.

H. Use other wiring methods only as specifically indicated on Drawings.

3.4 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Except as otherwise specifically noted, all wiring throughout the building, including each of the systems specified, shall be enclosed in raceways.

C. In general, all wire in raceways and cable shall be concealed above ceilings and within finished walls, securely supported in accordance with code requirements. Wiring in areas with no finished ceilings (exposed construction) shall be raceways exposed overhead, but run along structures such that raceways have minimum visibility and such that all raceways are parallel or perpendicular to joists, columns or beams and concealed in walls.

D. Use solid conductor for feeders and branch circuits #10 AWG and smaller. At contractors option stranded conductors for #10 AWG and smaller shall be permitted as long as vinyl insulated support crimp-on fork terminals are use for all screw head terminations. Barrel lugs and screw activated compression clamps on back wired devices shall not require crimp-on terminals.

E. Use stranded conductor for feeders and branch circuits #8 AWG and larger.

F. Use stranded conductors for control circuits.

G. Minimum Size Conductors for Power and Lighting Circuits #12 AWG Except as Follows:
1. Minimum #10 AWG for 120 volt circuits more than 100 feet long.
2. Sizes shall be not less than indicated.
3. Note: Wire sizes indicated on drawings and schedules are minimum requirements and shall be adjusted to meet the above criteria.

H. Use conductor not smaller than #14 AWG for control circuits with fusing sized accordingly.

I. Pull all conductors into raceway at same time.

J. Use suitable wire pulling lubricant for building wire #4 AWG and larger.

K. Support cables above accessible ceiling, using spring metal clips or approved cable ties to support cables from structure. Do not support from ceiling suspension system. Do not rest cable on ceiling panels. Do not drape over ductwork or between bar joists. Wiring shall not be run diagonally and shall be cabled neatly.

L. Use approved cable fittings and connectors.

M. Neatly train and lace wiring inside boxes, equipment, and panelboards.

N. Clean conductor surfaces before installing lugs and connectors.

O. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

P. Use split bolt connectors, insulation piercing connectors or U.L. approved insulated connectors for copper conductor splices and taps, #6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.

Q. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, #8 AWG and smaller.

R. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

S. Wiring in sleeves passing through fire-rated barriers shall be sealed/filled with approved material to maintain the fire rating.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Identify wire and cable under provisions of Division 26 Section 260195 “Electrical Identification”.

B. Identify each conductor with its circuit number or other designation indicated on Drawings.

3.6 FIELD QUALITY CONTROL

A. Inspect wire and cable for physical damage and proper connection.

B. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.

C. Verify continuity of each branch circuit conductor.

D. Verify proper operation of each circuit.

3.7 TESTING

A. For conductors larger than #8AWG, perform Insulation-Resistance Test on each field-installed conductor with respect to ground and adjacent conductors.
   1. Applied potential shall be 500 volts dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable.
   2. Take readings after 1 minute and until the reading is constant for 15 seconds.
   3. Minimum insulation-resistance values shall not be less than 25 Megohms for 300 volt rated cable and 100 Megohms for 600 volt rated cable.

END OF SECTION 260123

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SECTION 260130 - BOXES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wall and Ceiling Outlet Boxes.

B. Pull and Junction Boxes.

C. Hinged Cover Cabinet Enclosures.

D. Terminal Blocks and Accessories.

1.2 RELATED SECTIONS

A. Division 07 Section “Through Penetration Firestop Systems”.

B. Division 08 Section “Access Doors and Frames”.

C. Division 26 Section 260010 “Basic Electrical Requirements.”

D. Division 26 Section 260111 “Conduit.”

E. Division 26 Section 260141 “Wiring Devices.”

F. Division 26 Section 260170 “Grounding and Bonding.”

G. Division 26 Section 260180 “Equipment Wiring.”

1.3 REFERENCES

A. NEMA Standards.

B. NFPA 70 N.E.C. Latest Edition.

C. U.L. Standards.

1.4 SUBMITTALS

A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section “Submittal Procedures”.

B. Include product data for boxes larger than 12x12x6 inches and boxes with hinged covers.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01 Section “Project Record Documents”

B. Accurately record actual locations and mounting heights of outlets if not as shown on Drawings, plus pull and junction boxes larger than 12x12x6 inches and boxes used for panel feeders.

1.6 PERFORMANCE REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70. (N.E.C.)

B. Furnish products listed and classified by Underwriters' Laboratories, Inc. as suitable for purpose specified and shown.

C. Size per N.E.C. Art. 314.

D. Covers for flush floor devices and poke-through fittings shall meet UL scrub water standards for installation in carpet and tile floors.

1.7 PROJECT CONDITIONS

A. Verify field measurements are as shown on Drawings.

B. Verify locations of wall boxes and outlets in all areas prior to rough-in.

C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose.

D. Generally pull boxes are not shown on Drawings. Provide as required.

1.8 COORDINATION

A. Locate such that outlets are readily accessible and do not interfere with other work.

B. Provide for access panels where required.

PART 2 - PRODUCTS

2.1 OUTLET BOXES

A. Sheet Metal Outlet Boxes: Standard type galvanized steel, minimum four inch square or octagon by 2-1/8 inch deep.
   1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch male fixture studs where required.
   2. Concrete Ceiling Boxes: Concrete type, three and four inch deep or depth as to coordinate with concrete slab.
   3. Single Wall Type: Minimum size, four inch square by 1-1/2 inch deep, except as noted. Provide dry wall plaster rings raised as required to insure flush finish mounting.
   4. Ganged Wall Type: Minimum depth 3 inches except as noted, ganged as required under common plate to contain device shown.

B. Cast Boxes: Type FS (shallow) and type FD (deep), aluminum or cast feralloy.
   1. Provide number of threaded hubs as required.
   2. Use in all exterior, damp or exposed in mechanical space.
   3. Provide gasketed cover and accessories by box manufacturer for complete weatherproofing.

2.2 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: Standard type galvanized steel, minimum four inch square or octagon by 2-1/8 inch deep.
   1. Sizes up to 12x12x6 inch: Provide screw-type or hinged covers.
   2. Sizes greater than 12x12x6 inch: Provide hinged covers.

B. Surface-Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface-mounted junction box.
   1. Material: Galvanized cast iron or cast aluminum.
   2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

2.3 CABINET ENCLOSURES

A. Covers: Continuous hinge, held closed by flush latch operable by screwdriver, finish in gray baked enamel.

B. Boxes: Galvanized steel minimum 12"x12"x6" deep or as noted. Provide 3/4 inch (19 mm) thick plywood backboard painted matte white, for mounting terminal blocks.

C. Power Terminals: Unit construction type, closed-back type, with tubular pressure screw connectors, rated 600 volts.

D. Signal and Control Terminals: Modular construction type, channel mounted; tubular pressure screw connectors, rated 300 volts.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
   1. Except where specifically noted, boxes on finished surfaces shall be flush mounted with finished cover plate.
   2. Consult Architect prior to installing in finished areas.

B. Install electrical boxes to maintain headroom and to present neat mechanical appearance.

C. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

D. In Non-accessible Ceiling Areas: Install outlet and junction boxes no more than 12 inches from ceiling access panels or from removable recessed luminaires such that they are accessible.

E. In accessible Ceiling Areas: Install outlet and junction boxes such that they are accessible from ceiling access panels or from removable recessed luminaires.

F. Install boxes to preserve fire-resistance rating of partitions and other elements, using materials and methods under the provisions of Division 07 Section “Through Penetration Firestop Systems”.

G. Align Wall Boxes for Switches, Receptacles, Thermostats, Telephone, and Similar Devices with Each Other as Follows:
   1. Horizontally for outlets with same mounting height.

2. Vertically for outlets shown in similar locations with different mounting heights.

H. Do not install flush mounted boxes back-to-back in walls; provide minimum 6 inch separation. Provide minimum 24 inches separation in acoustic and fire rated walls.

I. Accurately position flush mounted wall boxes to allow for surface finish thickness.
1. Box shall be flush with finished surface.
2. Use wall box support brackets that span two studs.
3. Single stud support will be allowed only if used with Caddy H series E-Z Mount Brackets or equal product to support side opposite the stud.

J. Install flush mounting box without damaging wall insulation and vapor barrier or reducing its effectiveness.

K. Use adjustable steel channel fasteners for hung ceiling outlet box.

L. Do not fasten boxes to ceiling support wires.

M. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.

N. Use gang box where more than one device is mounted together. Do not use sectional box.

O. Use 4" square box with plaster ring for single device outlets.

P. Use cast outlet box in exterior locations exposed to the weather and wet locations.

Q. Large Pull Boxes: Boxes larger than 100 cubic inches in volume or 12 inches in any dimension.
1. Interior Dry Locations: Use hinged covers.
2. Other Locations: Use surface-mounted cast metal box.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations and sizes of required access doors with Division 08 Section “Access Doors and Frames”.

B. Coordinate masonry cutting to achieve neat opening.

C. Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes.

D. Position outlet boxes to locate luminaires as shown on reflected ceiling plan.

END OF SECTION 260130

SECTION 260141 - WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wall Switches.

B. Wall Dimmers.

C. Receptacles.

D. Device Plates.

E. Lighting Occupancy Sensors.

F. Relays and Contactors.

G. Cord reels.

H. Timeclocks.

1.2 RELATED SECTIONS

A. Division 07 Section “Through-Penetration Firestop Systems”.

B. Division 26 Section 260010 “Basic Electrical Requirements”.

C. Division 26 Section 260130 “Boxes.”

1.3 REFERENCES

A. NEMA Standards.

B. NFPA 70 N.E.C. Latest Edition.

C. U.L. Standards.

1.4 SUBMITTALS

A. Submit Shop Drawings for equipment and component devices in accordance with Division 01 Section “Submittal Procedures”.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

C. Include documentation showing compliance with UL, Fed. Spec. and NEMA references.

1.5 PERFORMANCE REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters' Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
   1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
   2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
   3. Leviton Mfg. Company Inc. (Leviton).
   4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

A. General Description: Receptacles shall be back and side wired, provide green ground screw terminal, automatic ground clamp, fully enclosed in composition case, nylon face, and have all brass wrap around bridge for installation strength. Receptacles shall be UL 498 listed, Fed. Spec. WC596 and NEMA WD-1, WD-6 compliant. Duplex Convenience Receptacle, NEMA 5-20R, Rated 20 Amp.

B. Duplex Convenience Receptacles, 125 V, 20 A:
   1. Cooper; 5351 (single), 5352 (duplex).
   2. Hubbell; HBL5361 (single), CR5352 (duplex).
   3. Leviton; 5891 (single), 5352 (duplex).
   4. Pass & Seymour; 5381 (single), 5352 (duplex)

C. Device Body:
   1. Wall mounted devices shall be brown.
   2. Ceiling mounted devices shall be white.

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped. Will not energize if line and load wiring are reversed.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
   1. Cooper; GF20.
   2. Hubbell; GFR5352
   3. Pass & Seymour; 2095

2.4 CORD REEL

A. Cord Reel: Hubbell # model HBLC40123TT for 120 volts.
   1. triple tap outlet.
   2. Rated 1875 watts 15 amps at 120 volts.
   3. 40 feet of 12/3 SJTW cable.

2.5 WALL SWITCHES

A. General Description: Wall Switches shall be specification grade, 20 ampere, toggle type, 120/277 V rated. Provide key switches (For keyed switches, provide minimum 2 keys per keyed device), three-way, and four-way switches as indicated. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:
   1. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
   2. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
   3. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
   4. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way)

C. Device Body:
   1. Toggle handle type, color: Brown.

D. Pilot Light: Neon type #1720-120v red. Separate gang position combined under same plate as switch or separately mounted.

E. Mushroom Panic Switches: Similar to Allen Bradley Series 800T-D6A, 1 N.O. & 1 N.C. momentary contacts mounted on flush stainless steel faceplate with appropriate flush backbox.
   1. Pushbutton Mushroom cylinder lock: Similar to Allen Bradley Series 800T-E15M6A plus button guard. Button shall lock when depressed and release only with key. Key removable in any position. Mount on flush stainless steel faceplate with appropriate flush backbox.
   2. Locate one Pushbutton cylinder lock at room door, ahead of Mushroom Panic Switches to allow instructor to lock out the room power.

2.6 LIGHTING OCCUPANCY SENSORS

A. Manufacturers:
   1. Hubbell H-Moss. Model numbers listed except as noted.
   2. Light-O-Matic
   3. Sensor Switch
   4. Leviton

B. Complete with Faceplates, Color:
   1. Ceiling mounted units shall be white, except as noted
   2. Wall mounted unit shall be ivory, except as noted.

C. Occupancy Sensor – Room and Corridor Ceilings: Hubbell OMNIDT2000 dual technology ceiling mounted sensor with auxiliary isolated relay and photocell.
   1. 24 VDC/VAC and half-wave rectified AC
   2. Ultrasonic frequency of 32-40kHz
   3. IntelliDAPT self-adaptive Technology:
      a. Auto reset from test setting.
      b. Self-adjusting timer; automatic mode (8-30 minute delay), test-mode (8 seconds). Set units for maximum 15 minute delay to OFF.
      c. Self-adjusting ultrasonic and passive infrared threshholds.
      d. Automatic false-on/false-off corrections.
   4. Built-in light level sensor works from 0 to 100 footcandles
   5. Auxiliary three wire isolated relay with N/O and N/C outputs; rated for 500mA @ 24 VDC for use by the Building Automation System.

6. Multi-level, 360° Fresnel lens for superior occupancy detection
7. Control unit (power pack): up to 4 sensors or 3 sensors and 1 Add-A-Relay. Include the Add-A-Relay for use by the Building Automation System.
8. Coverage: 2000 sq.ft.
9. ETL, UL, and cUL listed.
10. Five year warranty.
11. Provide control units (power packs) UVPP, mounting brackets and other hardware as required for a complete working system to cover the areas indicated.
12. Provide other "family" models for smaller spaces where the 2000 SF coverage is not required.
13. In corridor locations provide appropriate lens and adjustments for full coverage.

D. Occupancy Sensor - Wall Switch: Hubbell LHMTSI, LightHawk Multi-Technology ultrasonic and passive infrared wall-switch with the following features:
1. Dual 120/277 VAC operation.
2. Coverage – 1000 sq. ft., 180° range
3. Auto-ON and Manual-ON mode, initially program all for manual on operation.
4. IntelliDAPT self-adaptive Technology:
   a. Self-adjusting timer; automatic mode (4-30 minute delay), fixed mode (4, 8, 15, and 30 minutes), test-mode (5 seconds). Set units for maximum 15 minute delay to OFF.
   b. Self-adjusting ultrasonic and passive infrared sensitivity.
   c. Automatic false-on/false-off corrections.
5. Compatible with all electronic ballasts.
6. Zero crossing control circuitry.
7. Concealed service disconnect air gap switch.
8. ETL, UL, and cUL listed.
9. Five year warranty.
10. Provide dual circuit unit (LHMTD2) similar to above in all locations where two circuits or dual switching is required.

2.7 LED WALL DIMMERS

A. Manufacturers:
1. Leviton IP710-DL (0-10volt) Series except as indicated
2. Lutron
3. Lightolier
4. Lithonia

B. Plastic with linear slide and ON/OFF button.

C. 1200VA, 120/277 Volt AC 60Hz, Single-Pole & 3-Way, IllumaTech Preset Electro-Mechanical Electronic 0-10VDC Slide Dimmer with LED Locator Light.

D. Power circuit shall pass through dimmer ON/OFF button to Ballast or LED driver, plus separate pair of 0-10volt low voltage wires to dimming ballast or driver.

E. Push button switch shall acts as an air-gap switch completely disconnects power to dimming ballast or driver to allow for fixture service.

F. Power failure recovery shall ensure retention of last setting before power interruption.

2.8 STANDARD WALL DIMMERS

A. Manufacturers:
   1. Lutron. (Model NOVA-T Series except as indicated.)
   2. Lightolier
   3. Or equal

B. Plastic with linear slide.

C. Voltage: 120 volts.

D. Power Rating: No less than 125% of load shown on Drawings. Minimum rating: 1000 watts.

E. Device Body & Plate: Brown.

F. Note that dimmers shall be compatible with loads indicated. Where dimmers are shown serving electronic solid state low voltage transformers such as for MR16 lamps, then provide appropriate amplifier modules for proper operation. Dimmers shown serving LED shall be 0-10 VDC compatible with the specific drivers installed. Locate as indicated or above accessible ceiling. Wire as required by the manufacturer's installation instructions.

G. Device Body & Plate: Brown.

2.9 WALL PLATES

A. Decorative Cover Plate: Series 97000 stainless steel USD-32 with satin finish.

B. Rain-Tight While-in-use Cover Plates: NEMA 3R Clear cover extra deep, Leviton 5966-DCL Series.

C. Utility Area Cover Plates for Surface Mounting: Cadmium plated steel with rounded edges.

2.10 RELAYS/ CONTACTORS, AND TIME CLOCK CONTROLS

A. Similar to the following with characteristics as indicated or equal:

B. Control Relays: Allen-Bradley Bulletin "700" Series.
   1. 120 volt coil as required.
   2. Number of poles as indicated or required. Minimum number of poles: two.
   3. Minimum continuous ampere rating: 5 amps.
   4. Enclosure: NEMA-1, except as noted.
   5. Electrically held, except as noted.
   6. 600 volt rated.
   7. For non-lighting low voltage control applications.

C. Lighting Relays/ Contactors: Allen-Bradley Bulletin "500L" Series.
   1. 120 volt coil as required.
   2. Number of poles as indicated or required. Minimum number of poles: two.
   3. Minimum continuous ampere rating: 125 percent of the connected load, except minimum 20 amps.
   4. 600 volt rated.
   5. Enclosure: NEMA-1, except as noted.

6. Electrically held, except as noted.
7. Rated for lighting and heating loads.

D. Motor Load Relays/ Contactors: Allen-Bradley Bulletin "500" Series.
1. 120 volt coil as required.
2. Number of poles as indicated or required. Minimum number of poles: three.
3. Horsepower rated for connected motor, except minimum NEMA size 0.
4. 600 volt rated.
5. Enclosure: NEMA-1, except as noted.
6. Electrically held, except as noted.

E. Time Clock Control: Tork Model #DZS200-Series.
1. Digital two channel astronomical with LCD display.
2. 120volt, 240 volt and 277 volt as required to match voltage indicated.
3. 48 events per channel/per week.
4. 16 individual holiday dates.
5. 72 hour memory backup with rechargeable battery.
6. NEMA type III indoor/outdoor enclosure.
7. Contact ratings: 10 amperes at 277 volt.

F. Photoelectric Control: Tork # model 2101 for 120 volts and model 2104 for 277 volts.
1. Adjustable ON/OFF: ON range from 2 to 50 f/c.
2. Rated 2000 watts tungsten at 120, 240 and 277 volts.
3. Enclosure: Die-cast zinc, gasketed for exterior use.
4. Cell: Cadmium sulfide, 1" diameter.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install devices and plates vertical and plumb. Boxes shall be flush with finished surface.

C. Provide matching blank face plate for all unused wall boxes.

D. Install switches with Off position down.
1. Locate close to door frame on latch side of door, or beyond swing of door where appropriate.
2. Where door frames have side lights, switch shall be either located below side light where a 3'-0" mounting height is possible, or beyond the side light. Coordinate with door frame schedule.
3. Switches indicated in the same area at the same mounting heights shall be ganged together under a common plate.

E. Install wall dimmers to achieve full rating specified. Do not break off cooling fins. Mount in separate gangs as required.

F. Do not share neutral conductor on load side of dimmers.

G. Install receptacles with grounding pole on top.

END OF SECTION 260141

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SECTION 260149 – LIGHTING CONTROL SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pre-wired, microprocessor controlled relay panels with electrically held, electronically latched relays panels controlled via a complete list of communication based accessories including but not limited to, all wiring, digital switches, digital photocells, day-lighting sensors, Digital Time Clock (DTC), building automation systems, thermostats, and other contact closure or analog based devices and programming for a complete system.

B. Low Voltage panels, complete with relay modules, cards, interiors.

C. Low Voltage switches and faceplates.

D. Dataline Communications Network.

E. All programming, testing, training and performance of all operations of the intelligent system as indicated on the drawings and as herein specified.

1.2 RELATED SECTIONS

A. Division 26 Section 260100 “Basic Electrical Requirements”.

B. Division 26 Section 260141 “Wiring Devices” (for self-contained local controls).

1.3 SUBSTITUTIONS

A. Refer to Division 01 for Substitutions and Product Options.

1.4 PERFORMANCE REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by a nationally recognized testing laboratory such as Underwriters' Laboratories, Inc. or ETL as suitable for purpose specified and shown.

C. Include all necessary software, programming and the selection of the proper type and quantities of the system components to assure a complete, operational, and Code Compliant System.

D. Provide the Owner with all required components, interfaces, passwords and training to allow them full access to the programming features. See Part 3 of this Section for training and field services.

E. The drawings do not show all details of the System. It shall be the responsibility of the authorized supplier/installer to provide a fully operational system.

F. Special programming requirement:
   1. Where lighting zones are indicated to be controlled by interior day-lighting sensors,

provide programming as required to switch zones OFF when ambient lighting levels from day-light reach 40fc. Zones shall be switched ON when ambient lighting levels from day-light fall to 35fc or below.

1.5 PROJECT CONDITIONS

A. Low voltage wire and cable routing is not shown on the Drawings. Route wire and cable and determine exact lengths as required to meet project conditions.

1.6 SPARES PARTS

A. Provide a minimum of two spare low voltage relays in each panel.

B. Provide minimum of one low voltage replacement switch.

1.7 QUALIFICATIONS

A. Manufacturer:
   1. Company specializing in manufacturing the products specified in this Section with minimum five years documented experience.
   2. Company maintaining engineering and service departments capable of rendering advice regarding installation, programming and final adjustment of the system.

B. Manufacturer and/or Supplier/Installer (Vendor):
   1. Company authorized by the manufacturer with minimum five years experience.
   2. Company offering Start-up, training, Documentation, Programming, and extended service contracts for continuing factory authorized service after the initial warranty period.

1.8 SUBMITTALS

A. Submit Shop Drawings for equipment and component devices in accordance with Division 01 Section “Submittal Procedures”.

B. Product Data: Submit manufacturer's data on lighting control system and all components.

C. Shop Drawings: Submit dimension Drawings of all lighting control system components and accessories.

D. Typical Wiring Diagrams: Submit typical wiring diagrams for all components including, but not limited to, relay panels, relays, dimmer modules, low voltage switches, Boosters, Photocells, Day Lighting Sensors.

E. See Part 3, DOCUMENTATION for additional requirements.

1.9 SYSTEM DESCRIPTION

A. The lighting control system shall be a networked system that communicates via RS485. The system shall be able to communicate with fully digital centralized relay panels, micro relay panels with 0-10VDC dimming outputs, fully distributed fixture level control by bus connected relays or dimmers, (also referred to as X-Point) digital switches, photocells, daylight sensors,

various interfaces and shall include all operational software. Lighting control system shall include all hardware and software. Software shall be resident within the lighting control system. System shall provide local access to all programming functions at the master lighting control panel (LCP) and remote access to all programming functions via dial up modem and through any standard computer workstation. Lighting control system shall have the capability to be remotely controlled via the internet or building wide Ethernet LAN.

B. System software shall provide real time status of each relay, each zone and each group.

C. All devices shall be pre-addressed at the factory. Field addressing is not acceptable.

D. All programs, schedules, time of day, etc, shall be held in non-volatile memory for a minimum of 10 years at power failure. At restoration of power, lighting control system shall implement programs required by current time and date. Time of day shall be battery backed for at least 10 years.

E. The system shall be capable of implementing On commands, Off commands, for any relay, group or zone by means of digital wall switches, specification grade line voltage type wall switches, photocell, web based software or other devices connected to programmable inputs in a lighting control panel.

F. The lighting control system shall provide the ability to control each relay and each relay group per this specifications requirement. All programming and scheduling shall be able to be done locally at the master LCP and remotely via dial up modem and via the Internet. Remote connection to the lighting control system shall provide real time control and real time feedback.

G. System shall consist of centralized relay panels, micro relay panels, digital switches, day-light sensors, photocells and various digital interfaces. Verify exact components specified. Micro relay panels, centralized relay panels and digital switches shall communicate as one network via RS485. Micro relay panels, mounted in each local area, shall control all lighting fixtures in that space, provide power to occupancy sensors and take input from daylight sensor and occupancy sensors. Micro relay panels shall be capable of taking inputs from standard, line voltage type switches and outputting up to 8 independent 0v to 10v dimming signals. All micro relay panels and all devices connected to micro relay panels (switches, photocells and occupancy sensors, etc) shall be wired per lighting control manufacturers instructions.

H. X Point relay or dimming modules shall be fed from an X Point router that sits on the GR 2400 Bus in the manner of a relay panel. Individual modules shall be fed from this panel on a separate bus. Each router may feed two strings of up to 64 modules on a 2000ft string. Each Module may be a single relay, a dual relay or a dimming (0-10Volt) module. Relays in the modules shall be capable of being separately controlled in the same manner as an individual relay or dimmer in a relay or dimmer panel. Additionally multiple relays may be collected together to act together as a single multi-pole load or dimmer for ease of programming. Graphical software shall make assignments and reassignments in a straightforward and logical manner.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Lighting Control & Design (Numbers & system specified except as noted).

B. Hubbell

C. Greengate

D. Wattstopper

E. Leviton

2.2 GENERAL

A. Control wiring shall be in accordance with the NEC requirements for Class 2 remote control systems, Article 725 and manufacturer specification.

B. Lighting control panels (LCPs) shall be UL 916 listed. LCPs controlling emergency circuits shall be ETL listed to UL 924.

C. Lighting control system shall be digital and consist of a master LCP with up to 48 individual relays, slave LCPs with up to 48 individual relays in each panel, digital switches and digital interface cards. All system components shall connect in a "daisy chain" style configuration and be controlled via Category 5 patch cable with RJ45 connectors, providing real-time two-way communication with each system component.

D. Relay panels shall be pre-wired, pre-assembled, and preprogrammed.

E. Standard relays shall have normally closed (NC) contacts rated for 120/277V 20A tungsten, ballast or HID. Standard relays shall be zero-cross type. For site lighting, relays shall be 600V, 2-Pole relay, NO OR NC, rated minimum 20A.

F. Relay panel electronics shall provide current visual status and control of each relay or zone. All system control electronics shall store programming in a non-volatile memory and provide 10 year battery back up for time of day.

G. Lighting control system interfaces shall include a dry contact input interface, BMS (building management system) interface, Ethernet/internet interface and an interface to smart-breaker panel boards. Provide all interfaces required to perform as indicated on the drawings and specifications.

2.3 RELAY PANELS SHALL CONSIST OF THE FOLLOWING:

A. Relay Panels:
   1. NEMA-1 rated enclosure with hinged door.
   2. 16 AWG steel barrier shall separate the high voltage and low voltage compartments of the panel and separate 120v and 277v.
   3. LCP input power shall be capable of accepting 120V or 277V without rewiring
   4. Control electronics in the low voltage section shall be capable of driving 2 to 48 relays, control any individual or group or relays, provide individual relay overrides, provide a master override for each panel, store all programming in non-volatile memory, after power is restored return system to current state, provide programmable blink warn timers for each relay and every zone, and be able to control Normally Open (NO) or Normally Closed (NC) relays.
   5. All system components shall connect and be controlled via a single Category 5, 4 pair

twisted cable, providing real time two-way communication with each system component.

6. Panels used for life safety lighting shall have barriers to isolate the emergency circuits and shall have fail safe NC contacts to assure lighting is forced "ON" during power failure by monitoring the local normal circuit.
7. Low Voltage Relay Panels shall be equal to LC&D GR 2400 Series.

B. Micro Relay Panels

1. Micro relay panels shall have up to 8-30A, 18,000 SCCR rated lighting relays and shall control all lighting in the designated area indicated on the plans and be networked to centralized relay panels, micro relay panels, smart breaker panels, digital switches, photocells, various interfaces. Each micro relay panel shall provide minimum 300ma at 12/24VDC for powering occupancy sensors.
2. Micro relay panel shall provide a minimum 4-programmable photocell inputs, a minimum 4-programmable occupancy sensor inputs and matrixed contact closure inputs.
3. Micro relay panels shall be capable of outputting minimum 4 and up to 8 independent 0-10V dimming signals, one independent dimming signal at each of 8 relays. In order to maximize daylight harvesting and minimize disruption to occupants, each dimming output shall provide adjustment for baseline, start point, mid point, end point, trim, fade up rate, fade down rate, time delay and enable/disable masking. All photocell settings shall be remotely accessible.

C. Standard Output Relays

1. Electrically held, electronically latched SPST relay.
2. Relays shall be individually replaceable. Relay terminal blocks shall be capable of accepting two (2) #10AWG wires on both the line and the load side.
3. Rated at 20 Amp, 277VAC Ballast, Tungsten, HID, 1 HP at 120 Vac, 2 HP at 240 Vac.
4. Relays to be rated for 250,000 operations minimum at 20a lighting load, use Zero Cross circuitry and be Normally Closed (NCZC). All incandescent circuits shall be energized by use of a Normally Closed SoftStartT (NCSS) relay rated at 100,000 operations at full 20a load.
5. Optional relay types available shall include: Normally Open (NO) relay rated for 100,000 operations, a 600v 2-pole NO and NC and a Single Pole, Double Throw (SPDT) relay.

D. Low Voltage Switches

1. All switches shall communicate via RS 485, CAT 5 patch cable with RJ45 connectors. Any switch button function shall be able to be changed locally (at the DTC or at the PC) or remotely, via modem, Ethernet or Internet.
2. Switches shall be available in 1 through 6-button version with engraveable buttons, red LED annunciation for each button and a constantly On green LED locator.
3. Digital low voltage switch shall be a device that sits on the lighting control system bus. Digital switch shall connect to the system bus using the same cable and connection method required for relay panels. Each button shall be capable of being programmed for On only, Off only, Mix (Some on some off), On/Off (toggle), Raise (Dim up) and Lower (Dim down). Each button shall be able to be enabled or disabled over the bus.
4. Keyed switches shall be programmable and connect to the lighting controls system bus.

E. SWITCHES/PLATES
   1. Similar to LC&D GR 2400 Series Chelsea switches. Group the switches shown in close proximity under a common face plate.
      a. Single gang from 1 to 6 buttons.
      b. Programmable via TDC programmer and via MS-Windows Lighting Control Software in ATC PC.
      c. RS 485 bus protocol.
      d. Built-in RJ45 connectors (in & out)
      e. Standard decorator style faceplates.
      f. Provide matched Specification Grade plates of materials and colors to match devices specified under section Division 26 Section 260141 "Wiring Devices".

F. DTC - Digital Electronic Time Clock
   1. A Digital Time Clock (DTC) shall control and program the entire lighting control system and supply all time functions and accept interface inputs.
   2. DTC shall be capable of up to 32 schedules. Each schedule shall consist of one set of On and Off times per day for each day of the week and for each of two holiday lists. The schedules shall apply to any individual relay or group of relays.
   3. The DTC shall be capable of controlling up to 127 digital addresses on a single bus and capable of interfacing digitally with other individual busses using manufacturer supplied interface cards.
   4. The DTC shall accept control locally using built in button prompts and use of a 8 line 21-letter display or from a computer or modem via an on-board RS 232 port. All commands shall be in plain English. Help pages shall display on the DTC screen.
   5. The DTC shall be run from non-volatile memory so that all system programming and real time clock functions are maintained for a minimum of 10 years with loss of power.
   6. System shall come with a Pre-Installed modem that allows for remote programming from any location using a PC. Modem shall include all necessary software for local or remote control.
   7. DTC shall provide system wide timed overrides. Any relay, group or zoned that is overridden ON, before or after hours, shall automatically be swept Off by the DTC a maximum of 2 hours later.

G. Photocells:
   1. Photocells used for exterior lights shall provide multiple trip points from one (1) building/roof mounted unit. All trip points shall be able to be changed remotely via Internet or dial up modem.
   2. Photocells used for interior lighting control shall have multiple settings such as start-point, mid-point, off-point, fade-up, fade-down, etc. All settings shall be remotely accessible and adjustable.
   3. Photocell, exterior (PCO) or interior (PCI), shall provide readout on the DTC screen in number values analogous to foot-candles. Each photocell shall provide a minimum of 14 trigger points. Each trigger can be programmed to control any relay or zone. Each trigger shall be set through DTC, locally or remotely.
   4. Photocell Controls (low voltage lighting control system daylight sensor): Provide Photocell Controllers as required to support the daylight harvesting system. Photocells shall be similar to the following and compatible with the system specified: LC&D model iPC-L.

H. Provide the following Interfaces:
   1. A dry contact input interface card that provides 14 programmable dry contact closure inputs. Use shielded cable to connect input devices to interface card.
   2. Interface card providing digital communication from one system bus to another system bus, allowing up to 12,000 devices to communicate.
   3. An exterior (PCO) and interior (PCI) photocell that provides readout on the DTC screen in number values analogous to foot-candles. Each photocell shall provide a minimum of 14 trigger points. Each trigger can be programmed to control any relay or zone. Each trigger shall be set through programming only.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 26 Section 260141 “Wiring Devices”.

B. Mount relay control cabinets adjacent to respective lighting panelboard. Cabinet shall be surface mounted. Wiring between relay control cabinet and panelboards shall be per local codes and acceptable industry standards. Neatly lace and rack wiring in cabinets. During construction process, protect all interior components of each relay panel and each digital switch from water, dust and debris.

C. Switches: Provide outlet boxes, single or multi-gang, as required for the low voltage digital switches. Mount switches as indicated. Provide faceplates and the required low voltage cable, Category 5, 4 twisted pair, with pre-assemble RJ45 connectors and snag-less boots (commonly referred to as a Cat 5 patch cable) between all switches and panels. Field-test all Cat 5 patch cable with a recognized cable tester. All low voltage wire shall be run in EMT or ENT or as specifically indicated on the drawings.

D. Provide a crimping kit with sufficient approved EZ Brand RJ 45 connectors to populate the whole system. Include a manual that shows all the pitfalls of crimping RJ 45s and instructions on how to properly terminate the connectors.

E. Wiring:
   1. Do not mix low voltage and high voltage conductors in the same conduit.
   2. Ensure low voltage conduits or control wires do not run parallel to current carrying conduits.
   3. Place manufacturer supplied "terminators" at each end of the system bus per manufacturer instructions.
   4. Neatly lace and rack wiring in cabinets.
   5. Plug in Category 5, 4-twisted pair cable that has been field tested with a recognized cable tester, at the indicated RJ45 connector provided with each lighting control device, per manufacturer instructions.
   6. Use Category 5, 4 twisted pair cable for all system low voltage connections. Additional conductors may be required to compensate for voltage drop with specific system designs. Contact LC&D or refer to the GR2400 manual for further information.
   7. Use shielded cable for dry contact inputs to lighting control system.
   8. Do not exceed 4000ft-wire length for the system bus.
   9. All items on the bus shall be connected in sequence (daisy chained).

10. All wiring shall be per manufacturer’s instructions.

3.2 SEQUENCE OF OPERATION

A. System shall be initially set up to perform the following:
   1. On-Off control of interior lights with switch stations. Interior lights controlled by zone with interior day-lighting sensor.
   2. On-Off control of exterior lights with exterior photocell and time of day with digital time clock.

B. Other features as may be directed by Owner.

3.3 INSTALLATION AND SET-UP

A. Verify that conduit for line voltage wires enters panel in line voltage areas and conduit for low-voltage control wires enters panel on low-voltage areas. Refer to manufacturer's plans and approved shop drawings for location of line and low-voltage areas. It is the responsibility of the contractor to verify with lighting control manufacturer all catalog information and specific product acceptability.

B. For approved line voltage type micro relay panel switches connected to matrixed inputs of the micro relay panel, furnish #18 AWG solid conductors. For all other digital switches provide wiring required by system manufacturer.

C. For digital switches provide wiring required by system manufacturer.

D. Contractor shall test all low voltage cable for integrity and proper operation prior to turn over. Verify with system manufacturer all wiring and testing requirements.

E. Panels shall be located so that they are readily accessible and not exposed to physical damage.

F. Panel locations shall be furnished with sufficient working space around panels to comply with the National Electric Electrical Code.

G. Panels shall be securely fastened to the mounting surface by at least 4 points.

H. Unused openings in the cabinet shall be effectively closed.

I. Cabinets shall be grounded as specified in the National Electrical Code.

J. Lugs shall be suitable and listed for installation with the conductor being connected.

K. Conductor lengths shall be maintained to a minimum within the wiring gutter space. Conductors shall be long enough to reach the terminal location in a manner that avoids strain on the connecting lugs.

L. Maintain the required bending radius of conductors inside cabinets.

M. Clean cabinets of foreign material such as cement, plaster and paint.

N. Distribute and arrange conductors neatly in the wiring gutters.

O. Follow the manufacturer's torque values to tighten lugs.

P. Before energizing the panelboard, the following steps shall be taken:
   1. Retighten connections to the manufacturer's torque specifications. Verify that required connections have been furnished.
   2. Remove shipping blocks from component devices and the panel interior.
   3. Remove debris from panelboard interior.
   4. Follow manufacturers' instructions for installation and all low voltage wiring.

Q. Service and Operation Manuals:
   1. Submit operation and service manuals. Complete manuals shall be bound in flexible binders and data shall be typewritten.
   2. Manuals shall include instructions necessary for proper operation and servicing of system and shall include complete wiring circuit diagrams of system, wiring destination schedules for circuits and replacement part numbers. Manuals shall include as-built cable Project site plot plans and floor plans indicating cables, both underground and in each building with conduit, and as-built coding used on cables. Programming forms of systems shall be submitted with complete information.

3.4 DOCUMENTATION

A. Each relay/dimmer module shall have an identification label indicating the originating branch circuit number and panelboard name along with the relay number. Each line side branch circuit conductor shall have an identification tag indicating the branch circuit number.

B. Provide a point-to-point wiring diagram for the entire lighting control system. Diagram shall indicate exact mounting location of each system device. This accurate "as built" shall indicate the loads controlled by each relay/dimmer module and the identification number for that module, placement of switches and location of photocell. Placed copy of drawing inside the door of each LCP.

3.5 SUPPORT SERVICES

A. Manufacturer's Field Services.
   1. Provide the services of a factory authorized technical representative of the manufacturer of the equipment to supervise the installation and final connections, plus adjusting, programming and all testing of the system required to assure a complete and fully operative system and to instruct designated personnel in the operation, adjustment, testing and maintenance of the system.
   2. Inspect final connections to units prior to energizing system.
   3. Perform field inspection and testing.

B. Provide initial programming as required to activate local switches. Adjust scheduling as directed by Owner.

3.6 ON SITE TRAINING

A. Provide a factory technician for on-site training of the owners' representatives and maintenance personnel.

B. Before Substantial Completion, arrange and provide a two-hour Owner instruction period to

designated Owner personnel. Set-up, commissioning of the lighting control system, and Owner instruction includes:

1. Demonstrate entire system operation and communication to each device.
2. Demonstrate operation of individual relays, switches, occupancy sensors and daylight sensors.
3. Confirmation of system Programming, photocell settings, override settings, etc.

C. Provide training to cover installation, maintenance, troubleshooting, programming, and repair and operation of the lighting control system.

END OF SECTION 260149

SECTION 260170 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Grounding electrodes and conductors.

B. Equipment grounding conductors.

C. Bonding.

1.2 RELATED SECTIONS

A. Division 26 Section 260010 “Basic Electrical Requirements.”

1.3 REFERENCES

A. NEMA Standards.

B. NFPA 70 (N.E.C.) Latest Edition.

1.4 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: Conform to requirements of ANSI/NFPA 70. (N.E.C.), except that the Minimum System Resistance shall be 10 ohms.

1.5 SUBMITTALS

A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section ”Submittal Procedures”.

B. Product Data: Provide data for grounding electrodes and connections.

C. Manufacturer's Instructions: Include instructions for protection, examination, preparation and installation of exothermic connectors.

1.6 GROUNDING ELECTRODE SYSTEM

A. All connections shall be made by Exothermic weld. Connections to thin water pipe shall be made by accessible clamp.

B. Ground Ring at Transformer Pad.
   1. 4/0 bare copper direct buried 3'-0" continuous around pad at 4'-0" beyond pad.
   2. Ground rod at each corner and one in pad hand hole.
   3. Extend ring with #4/0 to building main distribution panel. Do not connect ring to ground rod in pad hand hole.

C. Minimum 4/0 copper home run from main distribution panel to building steel.

D. Rod electrode.

E. Metal underground water pipe.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01 Section “Project Management and Coordination”.

B. Accurately record actual locations of grounding electrodes.

PART 2 - PRODUCTS

2.1 ROD ELECTRODE

A. Manufacturers:
1. Erico, Eritech copper bonded ground rod.
2. Substitutions: Under provisions of Division 01 Section “Substitutions and Product Options”.

B. Material: Copper-clad carbon steel.

C. Diameter: 3/4 inch.

D. Length: Sectional 10 feet.

2.2 MECHANICAL CONNECTORS

A. Manufacturers:
1. Thomas & Betts/Blackburn, Model J2D.
2. Substitutions: Under provisions of Division 01 Section “Substitutions and Product Options”.

B. Material: Bronze.

2.3 EXOTHERMIC CONNECTIONS

A. Manufacturers:
1. Erico, Cadweld.
2. Continental Industries, thermOweld.
3. Burndy, BURNDYWeld.
4. Substitutions: Under provisions of Division 01 Section “Substitutions and Product Options”.

2.4 WIRE

A. Material: Copper.

B. Grounding Electrode Conductor: Size to meet NFPA 70 requirements, but not smaller than indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 INSTALLATION

A. Install Products in accordance with manufacturer's instructions.

B. Install rod electrodes at locations indicated and as required. Install additional rod electrodes as required to achieve specified resistance to ground.

C. Install ground wire from water entrance to main entrance switchboard. Provide additional ground wire from main service to building structural steel. Enclose wire in PVC-40 where exposed.

D. Equipment Grounding Conductor: Provide separate, 600 volt insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

E. Provide and install bonding conductor to each item of electrical equipment.

F. Bonding conductors shall be continuous where possible. Where splices are required, provide T & B, or approved equal, compression connectors of approved pattern. Insulate connectors to equivalent thickness of conductors.

G. Provide grounding system for neutrals of dry type transformer secondaries as indicated and required.

H. Bond together metal siding not attached to grounded structure; bond to ground.

END OF SECTION 260170

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SECTION 260180 - EQUIPMENT WIRING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electrical connections to equipment specified under other Sections, and or the Owner including but not limited to: exhaust fans, handling units, air-conditioning units, pumps, heating system; pumps, burners, etc...

B. All line voltage wiring including final branch circuit connections to disconnects, motor controllers, Variable Frequency Drives (VFD), Isolation transformers, and motors. See Equipment Schedules on Drawings for wiring and plans for equipment locations.

C. Fused and non-fused disconnect switches for the equipment, except disconnect switches specifically provided with the equipment.

D. Except as specifically noted, motors, variable frequency drives (VFD), isolation transformers for VFD, magnetic or manual starters and thermal overload protection will be furnished with the equipment for installation under Division 26 Section 260180.
   1. Single pole switches, switch and pilots, and light/fan switches shall be provided and installed under Division 26 Section 260180. Coordinate with equipment schedules on Mechanical Drawings.

E. Temperature Control Wiring: Provided and installed under Division 23 Section “Instrumentation and Controls for HVAC Systems”.

F. Overhead Door Control Wiring: Door control panels and controllers provided under Division 08. All interconnecting wiring for fully operational overhead doors, including final connections to controllers and door operators, is included under Division 26 Section 260180.

G. Roof Top Equipment: Whether shown or not on the Drawings, provide a weather proof GFCI service receptacle at units per code requirements. For 120 volt, 15 and 20 amp equipment, connect to line side of safety switch. For larger equipment, provide home run to nearest 120 volt, 20A, 1 pole spare breaker. Label and show on as-built drawings.

1.2 RELATED SECTIONS

A. Division 01 Section "Summary".

B. Division 08 Openings.

C. Division 22 Section “Plumbing”.

D. Division 23 Section “Heating Ventilation and Air Conditioning”.

E. Division 26 Section "Basic Electrical Requirements".

1.3 REFERENCES

A. NEMA Standards.

B. NFPA 70 (N.E.C.) Latest Edition.

C. U.L. Standards.

D. ANSI Standards.

1.4 PERFORMANCE REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70. (N.E.C.)

B. Furnish products listed and classified by Underwriters' Laboratories, Inc. (U.L.) as suitable for purpose specified and shown.

C. Drawings do not show all required disconnect servicing switches. Furnish and locate as required by N.E.C.

D. Size fuses and thermal elements per N.E.C. and manufacturer's recommendations.

E. Connect motors for correct voltage, phase and rotation.

1.5 SUBMITTALS

A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section "Submittal Procedures".

B. Include disconnect devices, wiring connections, special outlets.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Eaton/Cutler-Hammer.

B. I-T-E Siemens.

C. General Electric.

D. Square D.

2.2 DISCONNECT SWITCHES

A. Enclosed, heavy-duty type, except as noted with visible blades, Horsepower rated 600-volt and 250-volt ratings as required by the particular circuit.

B. NEMA-1 enclosure, for dry locations; NEMA-3R rain-tight for exterior locations.

C. Fuses and ampere rating and number of poles as indicated on Drawings, or as required by the specific equipment.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 PREPARATION

A. Review equipment submittals prior to installation and electrical rough-in. Verify location, size, and type of connections. Coordinate details of equipment connections with supplier and installer.

3.3 INSTALLATION

A. Use wire and cable with insulation suitable for temperatures encountered in heat-producing equipment, but in no case less than the wire specified under Division 26 Section 260123 “Wire and Cable.”

B. Conduit Connections to Equipment: Dry, damp and wet locations, use flexible liquidtight Type UA conduit with approved liquidtight fittings. Maximum length two feet (2').

C. Install pre-finished cord set where connection with attachment plug is indicated or specified, or use attachment plug with suitable strain-relief clamps.

D. Provide suitable strain-relief clamps for cord connections to outlet boxes and equipment connection boxes.

E. Semiportable Machines: Use heavy-duty oil-resistant type SO cord with stranded copper conductors No. 12 AWG, minimum size and number of wires as required to include each phase conductor, white neutral conductor, and green grounding conductor. Furnish and install Kellems Series H cord grips and spring hangers for each cord connected machine with overhead supply.

F. Make wiring connections in wiring compartment of prewired equipment in accordance with manufacturer's instructions.

G. Install disconnect switches, controllers, control stations, temperature switches as indicated or required.

H. Overhead Doors: Mount door control panels. Coordinate with overhead door manufacturer for proper wiring diagrams and final connection requirements.

END OF SECTION 260180

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SECTION 260195 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Nameplates and Tape Labels.

B. Wire and Cable Markers.

C. Conductor Color Coding.

D. Conduit Color Coding.

1.2 RELATED SECTIONS

A. Division 09 Section “Painting”.

B. Division 26 Section 260010 “Basic Electrical Requirements.”

1.3 REFERENCES

A. NFPA 70 (N.E.C.) Latest Edition.

1.4 REQUIREMENTS

A. Label all panelboards, all disconnect (safety) switches, controls, relays, junction boxes, pull boxes, pilot lights, special switches and outlets. Label on panelboards shall include name and circuit number of source.

B. Nameplates shall identify function of device, space controlled, voltage conditions, fuse size, panel serving switch, as indicated or required without abbreviations. Details shall be as approved.

C. Conform to requirements of ANSI/NFPA 70. (N.E.C.) Art. 200 for grounded neutral conductor, Art. 210 for branch circuits and art. 250 for grounding (bonding) conductor.

1.5 SUBMITTALS

A. Submit Shop Drawings, in accordance with Division 01 Section “Submittal Procedures”.

B. Only include if details of nameplates, wiring markers and conductor color code are not as specified below.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Nameplates: Engraved three-layer laminated plastic, white letters on a black background.

B. Tape Labels: Embossed adhesive tape, with 3/16 inch white letters on black background.

C. Junction Box Labels: Hand lettered with indelible black marker. Indicate voltage and circuit.

D. Wire and Cable Markers: Cloth markers, split sleeve or tubing type.

E. Fire Alarm Junction Boxes: Paint red.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install nameplates and tape labels parallel to equipment lines.

B. Secure nameplates to equipment fronts using screws, or rivets, or adhesive. Secure nameplate to inside face of recessed panelboard doors in finished locations. Secure nameplate to outside face of surface panelboards in unfinished locations.

C. Use embossed tape only for identification of individual wall switches and receptacles, tape label shall be located on inside of wall plate.

3.2 WIRE IDENTIFICATION

A. Conductors throughout the building shall be color coded to identify voltage and phases.
   1. All metallic bonding conductors - Green.
   2. Insulated Isolated Grounding Conductor: Green with yellow stripe.
   3. Phase Conductors of 120/208 Volt System: Black, red, blue. Neutral: white.

B. All circuit conductors of the same color shall be connected to the same ungrounded feeder conductor throughout the installation.

C. Where conductors are not available in the colors indicated, due to size, prewired cable, or other reason: Install identifying adhesive bands 3/4" wide of colors indicated above around each conductor within six inches (6") and twelve inches (12") of each end and at a maximum of five foot (5') intervals along wireways, at back of panelboards, and wherever conductors are accessible.

D. Power and lighting circuits in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection: Provide wire markers on each conductor and Identify with branch circuit or feeder number.

E. System control wires at control panel and load connection:
   1. Provide wire markers on each conductor and identify with number as indicated on manufacturer's schematic and interconnection diagrams, and equipment manufacturer's Shop Drawings.
   2. Fire Alarm System: Follow local Fire Department color code and labeling standards.

END OF SECTION 260195

SECTION 260300 - PRIMARY ELECTRICAL DISTRIBUTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The intent is to disconnect, remove and properly dispose of the existing pad mounted transformer and replace with a new transformer. Provide new bushing wells, and inserts with the transformer and replace the existing load-break elbows if required to properly match other hardware. The intent is to reuse the existing cables on both sides of the transformer.

B. Pad-Mounted Transformers.

C. Medium Voltage Cables.

D. Medium Voltage Splice Kits.

E. Medium Voltage Terminating Kits.

1.2 RELATED SECTIONS

A. Division 32 Section "Exterior Improvements."

B. Division 33 Section "Utilities."

C. Division 26 Section 260010 "Basic Electrical Requirements."

D. Division 26 Section 260420 “Service Entrance”

1.3 REFERENCES

A. NEMA Standards.

B. ANSI/IEEE C2 - National Electrical Safety Code.

C. NFPA 70 (N.E.C.) Latest Edition.

D. U.L. Standards.

E. ANSI Standards.

1.4 PERFORMANCE REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70. (N.E.C.)

B. ANSI/IEEE C2 - National Electrical Safety Code.

C. Medium voltage is defined as 1,000 to 35,000 volts.

D. All overhead electrical work shall, as a minimum, be in accordance with the rules of the NEC and ANSI C2, Electrical Safety Code, latest edition.

E. Medium voltage work for this project is 12470/7200 volts, 3 phase, grounded wye, neutral conductor is required and is carried in the distribution system using 1/3 capacity neutral concentric conductors.

1.5 QUALIFICATIONS

A. Manufacturer:
1. Company specializing in manufacturing the products specified in this Section with minimum five years documented experience.
2. Company maintaining engineering and service departments capable of rendering advice regarding installation.

B. Installer:
1. Company specializing in applying work of this Section with minimum three years documented experience.
2. Company offering repair service contracts.
3. Company with certified trades persons.
4. Cable splicer working on this project shall have a minimum of 5 years experience in terminating and splicing 15 kV medium voltage cable and shall have experience installing the terminations and splices specified.

1.6 SUBMITTALS

A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section "Submittal Procedures."

B. Include all materials, equipment and components specified under this Section.

C. Include Certification of Competency: Cable splicer's experience during the past three years, describing performance in splicing and terminating cables of the type and classification being provided under the contract.

D. Submit manufacturers' instructions.

E. Terminator manufacturer's installation instructions.

F. Typical installation instructions for splicing and terminating kits.

G. Include Pad transformer and internal loop feed switch details, primary fusing details.

1.7 PROJECT CONDITIONS

A. The intent is to replace an existing pad mounted transformer, currently feeding the central heating plant and Woodbury Campus Center, while maintaining continuity of the campus primary distribution system. Provide all work and coordination as required to implement the new work.

B. Wire and cable routing, shown on Drawings are approximate unless dimensioned. Route and locate as required to meet Project Conditions.

C. Details on Drawings are diagrammatic only to show intent. Details of installation shall conform

to standards of the Rural Electrification Authority, and ANSI C2.

1.8 EXTRA MATERIALS

A. Furnish a spare fuse for each fuse provided.

PART 2 - PRODUCTS

2.1 THREE-PHASE PAD-MOUNTED TRANSFORMERS, DEAD-FRONT

A. Acceptable Manufacturers:
   1. Cooper Power Systems (RTE) or equal.
   2. General Electric.
   3. Square D.
   4. ITE-Siemens.

B. ANSI C57.12.28 with separate Medium and low-voltage compartments, primary switching and fuses, and accessories. Tamper resistant welded weatherproof enclosure with interlocking doors and penta-head bolt/padlock handle assembly on low voltage door. Provide bolted access handhole at transformer top.

C. Compartments: Divided medium and low-voltage compartments in sections with steel isolating barriers extending the full height and depth of the compartment.

D. Compartment Doors: hinged lift-off type with stop in open position and three-point latching.

E. Medium-Voltage Compartment: Contain the incoming line, insulated Medium-voltage load-break connectors, inserts, transformer medium-voltage bushing wells, connector parking stands dead-front surge arresters, load-break switch handle, access to oil-immersed fuses, externally-operated pad-lockable no load tap changer, drain valve and sampler, and ground pad.
   1. Insulated Medium-voltage load-break connectors IEEE 386.
   2. Bushing well and insert ratings:
      a. 125 kV BIL, rated voltage 8.3 kV for operation on a 12.47 kV system.
      b. Current rating: 200 amperes rms continuous.
      c. Fault Close-in: 10,000 A.
      d. Corona Extinction: 19 kV.

F. Load break inserts and bushings plus load break elbows: The product of a single manufacturer and provide with the transformer to insure compatibility.

G. Load-break elbow connectors: Complete with steel reinforced hook-stick eye, grounding eye, and arc-quenching contact material all sized for the medium voltage cable specified and provided with transformer to insure compatibility.

H. Load-Break Oil Rotary switch (LBOR): Four position sectionalizing loop-feed oil-immersed type, gang-operated, spring loaded quick-make quick-break. Positions: 1. A-B-Coil (feed-thru), 2. B-Coil, 3. A-coil, 4. Open.
   1. Locate the switch handle in the medium-voltage compartment.
   2. LBOR ratings:
      a. 125 kV BIL, rated voltage 27 kV L-L, 15.5 kV L-G.

b. Current rating: 200 amperes rms continuous.
c. Making current: 12 kA RMS Sym/19.2 kA Assym.

I. Primary Fuses: 150-kV fuse assembly with fuses complying with IEEE C37.47. Rating of current-limiting fuses shall be 50-kA RMS at specified system voltage.
1. Bay-O-Net liquid-immersed fuses in series with liquid-immersed current-limiting fuses. Bay-O-Net fuses shall be externally replaceable without opening transformer tank.

J. Parking stands: Provide a parking stand near each bushing well.

K. Low-voltage Compartment: Containing liquid temperature and level gages, cable lugs, low-voltage bushings, pressure relief valve, filling provisions, stainless steel transformer nameplate, and ground pad.

L. Transformer: Oil insulated, two winding, 60 hertz, 65°C rise above a 30°C average ambient, self-cooled type.
1. Rated 500kVA.
2. 95kV BIL, Medium voltage of 12.47kV wye primary, with four 2-1/2 percent full capacity taps two above and two below rated primary voltage.
3. Secondary voltage: 208Y/120.
4. Minimum tested impedance: Not less than 4.7%.
5. Tap changer: Externally operated, manual type for changing tap setting when the transformer is de-energized.
6. Transformer kVA and voltage ratings: Conspicuously displayed on the exterior of its enclosure.
7. The transformer shall have an insulated low-voltage neutral bushing with removable ground strap with lugs for ground cable.

M. Insulating Liquid: Less flammable, edible-seed-oil based, and UL listed as complying with NFPA 70 requirements for fire point of not less than 300°C when tested according to ASTM D 92. Liquid shall be in conformance with FM Approval Standard 6933. Liquid shall be readily biodegradable and nontoxic. Listed less-flammable fluid meeting the requirements of National Electrical Code® Section 450-23 and the requirements of the National Electrical Safety Code (IEEE C2-1997), Section 15. The dielectric coolant shall be readily and completely biodegradable per EPA OPPTS 835.3100. The base fluid shall be 100% derived from edible seed oils with performance enhancing additives. The fluid shall be published under US EPA Environmental Technology Verification (ETV) requirements, and tested for compatibility with transformer components. The fluid shall be Factory Mutual Approved, UL® Classified Dielectric Medium (UL-EOUV) and UL Classified Transformer Fluid (UL-EOVK), Envirotemp® FR3® fluid.

N. Corrosion Protection Using ALL Processes in Order Listed:
1. Phosphate coating on pretreated, clean bare metal.
2. Epoxy primer using a cationic electro-deposition dip process. Minimum 0.0005" thick.
3. Baked-on Electrostatic thermosetting polyester powder spray. Minimum 0.0015" thick.
4. Coating of urethane spray paint for final color. Minimum 0.0010" thick.
5. Final color: Green.

O. Accessories:
1. Drain Valve: 1 inch (25 mm), with sampling device.

2. Dial-type thermometer.
3. Liquid-level and temperature gages.
4. Pressure-vacuum gage.
5. Pressure Relief Device: Self-sealing with an indicator.
6. Mounting provisions for low-voltage current transformers.
7. Mounting provisions for low-voltage potential transformers.
8. Warning Signs: Provide on door: "DANGER HIGH VOLTAGE KEEP OUT".

2.2 UNDERGROUND DISTRIBUTION

A. Existing.

B. Medium Voltage Wires and Cables: Shielded cable, copper conductors.
1. Rated: 15kV, 133 percent insulation level.
2. Conductor: Annealed uncoated copper, compact stranded per ASTM B-496.
3. Conductor Screen: Extruded semiconducting EPR conforming to ICEA S-94-649 and AEIC CS8.
4. Insulation: Ethylene-propylene based (EPR) conforming to ICEA S-94-649 AEIC CS8.
5. Insulation Screen: Extruded semiconducting EPR conforming to ICEA S-93-639/NEMA WC74, S-97-682, AEIC CS8 and UL1072.
6. Concentric conductor: Bare copper wires, 1/3 neutral capacity.
7. Jacket: Polyvinyl chloride (PVC), oil, acid, chemical and sunlight resistant.
8. Designed for both wet and dry locations.
9. Equal to Okonite type URO-J, sized as indicated.
10. Shall meet the following manufacturers' published data:

Conductor Size	AMPS Direct Burial	AMPS Underground Duct
2 AWG	225	165
1 AWG	260	185
1/0 AWG	295	215
2/0 AWG	335	245
3/0 AWG	380	275
4/0 AWG	435	315
250 kcmil	475	345
350 kcmil	575	415
500 kcmil	700	500
Three Conductor 105 deg C, 100% load, Earth Temp 20 deg C, RHO=90		

C. Lightning Arresters: M.O.V.E. deadfront Arrester designed to plug in same as a loadbreak elbow. Ratings selected by manufacturer of the pad transformer for the voltage indicated. Provide one per phase on source side at pad using load break feed thru inserts. Provide proper grounding.

D. Medium Voltage Termination:
1. Medium Voltage Cable Terminations: IEEE 48 Class 1 (exterior wet locations). Include all components, and materials which shall include stress relief cones/ devices, plus complete manufacturer's instructions for installation.
2. Cast Epoxy Resin Type Termination: IEEE 48, Class 1, terminating single conductor, solid insulated, nonmetallic jacketed type cables for service voltage up to 15 kV outdoors.

Terminations for shielded conductors shall include stress control, with a shield ground connection brought out through the insulation and covering, and grounded at installation. Terminations exposed to the weather shall include porcelain insulator and weather shield.]

E. Medium Voltage Permanent Splices:
   1. Medium Voltage Cable Splices: IEEE 48 Class 1 (exterior wet locations). 15kV, 200A, permanent, fully-shielded, fully submersible cable joint, EPDM rubber, designed specifically for the medium voltage cables being spliced. Manufactured in full compliance with all applicable IEEE standards, 404 and 592. Include all components, and materials which shall include stress relief cones/ devices, plus complete manufacturer's instructions for installation.
   2. As manufactured by Cooper Power Systems, One-Piece EZ II Splice or equal.

PART 3 - EXECUTION

3.1 GROUNDING ELECTRODES

A. Provide driven ground rods as specified in Division 26 Section 260170 “Grounding and Bonding”.

B. Connect ground conductors to the upper end of the ground rods by exothermic weld.

C. Provide compression connectors at equipment end of ground conductors.

3.2 GROUNDING

A. Grounding: NFPA 70 and ANSI C2, and Power Company requirements, except that grounds and grounding systems shall have a resistance to solid earth ground not exceeding 5 ohms. Provide multiple ground rods as required.

B. Make joints in grounding conductors and taps to ground ring by exothermic weld, Cadweld or equal.

3.3 PAD-MOUNTED TRANSFORMER GROUNDING

A. Grounding: NFPA 70 and ANSI C2, and Power Company requirements, except that grounds and grounding systems shall have a resistance to solid earth ground not exceeding 5 ohms. Provide multiple ground rods as required.

B. Connect copper grounding conductors to the ground loop as specified. In addition to the bonding strap provided by the manufacturer, provide a ground conductor from the transformer secondary neutral to the ground loop.

C. Make joints in grounding conductors and taps to ground ring by exothermic weld, Cadweld or equal.

3.4 INSTALLATION UNDERGROUND WORK

A. Earthwork: Excavation, backfilling, and pavement repairs for electrical requirements are specified under Divisions 31, 32, 33.

B. Install and make all final connections to pad-mounted transformers furnished under this section as indicated on project drawings, the approved shop drawings, and as specified herein. Mount transformers on concrete slab and secure with at least four anchor bolts.

C. Disconnect, remove and properly dispose of existing pad mounted transformer.

D. Cable Pulling: Test duct lines with a mandrel and thoroughly swab out to remove foreign material before the pulling of cables. Pull cables down grade with the feed-in point at the manhole or buildings of the highest elevation. Accumulate cable slack at each manhole or junction box and train the cable around the interior to form one complete loop. Minimum allowable bending radii shall be maintained in forming such loops.
   1. Lubricants for assisting in the pulling of jacketed cables shall be those specifically recommended by the cable manufacturer.
   2. Cable pulling tensions shall not exceed the maximum pulling tension recommended by the cable manufacturer.

E. Cable Terminating: Install all terminations in accordance with the manufacturer's requirements. Make terminations using materials and methods designated by the written instructions of the cable manufacturer and termination kit manufacturer.

3.5 TESTING

A. Provide earth ground testing at each existing transformer, manhole and vault.
   1. Resistance of the grounding electrode system shall be measured using an earth ground testers that can perform earth ground loop resistances using only clamps (Stakeless testing). This method shall not require the use of earth ground stakes or the disconnection of ground rods. Tester shall automatically determine the ground loop resistance at the grounding connection. Clamp-0n earth ground resistance tester jaws shall clamp completely around the conductor to be tested.
   2. If ground resistance is over 5 ohms, then install a second ground rod.

B. Typical medium voltage cable D.C. High Potential testing is not required on this project.

C. Perform Insulation-Resistance Test on each existing cable feeding the new transformer with respect to ground and adjacent conductors.
   1. Applied potential shall be 1,000 volts dc for 600 volt rated cable and 5,000 volts dc for medium voltage cables.
   2. Take readings after 1 minute and until the reading is constant for 15 seconds.
   3. Minimum insulation-resistance values shall not be less than 100 Megohms. If lower readings are measured, contact the cable manufacturer for trouble shooting and for authorization to energize.

END OF SECTION 260300

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SECTION 260420 - SERVICE ENTRANCE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Underground duct banks, conduits and secondary wires from pad mounted transformer to service entrance equipment.

B. Primary and secondary lugs.

1.2 RELATED SECTIONS

A. Division 26 Section 260010 “Basic Electrical Requirements.”

B. Division 26 Section 260111 “Conduit.”

C. Division 26 Section 260123 “Wire and Cable.”

D. Division 26 Section 260130 “Boxes.”

E. Division 26 Section 260170 “Grounding and Bonding.”

F. Division 31 Section “Earthwork.”

1.3 SYSTEM DESCRIPTION

A. System Voltage: 120/208 volts, three phase, four wire, 60 Hertz.

B. Service Entrance: As indicated on Drawings.

1.4 REFERENCES

A. NEMA Standards.

B. NFPA 70 (N.E.C.) latest edition.

C. U.L. Standards.

D. ANSI Standards.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70. (N.E.C.) and ANSI C2 National Electrical Safety Code.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. (U.L.) as suitable for purpose specified and shown.

1.6 SUBMITTALS

A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section “Submittal Procedures”.

PART 2 - PRODUCTS

2.1 METERING EQUIPMENT

A. See Specification Section 260470 “Panelboards” for required metering equipment.

2.2 SECONDARY CONDUCTORS

A. Specified under Division 26 Section 260123 “Wire and Cable”.

2.3 PRIMARY CONDUCTORS

A. Specified under Division 26 Section 260300 “Primary Electrical Distribution”.

2.4 CONDUITS AND DUCT BANKS

A. Specified Under Division 26 Section 260111 “Conduit”.

B. Trenching, Backfill, Earthwork: Specified under Division 31 and 32.

2.5 OTHER MATERIALS

A. Concrete Pad for Transformer: Existing

B. Transformer secondary lugs and spades to accept service conductors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Underground: Install service entrance conduits from pad-mounted transformer to building service entrance equipment. Make all connections as required.

B. Earthwork: Excavation, backfilling, and pavement repairs for electrical requirements are specified under Divisions 31, 32, 33.

END OF SECTION 260420

SECTION 260470 – PANELBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Panelboards.

B. Individually mounted circuit breakers.

C. Surge Protective Devices (SPD).

D. Metering.

1.2 RELATED SECTIONS

A. Division 01 Section "Submittal Procedures".

B. Division 06 Section "Rough Carpentry".

C. Division 09 Section "Painting".

D. Division 26 Section 260010: Basic Electrical Requirements.

E. Division 26 Section 260170: Grounding and Bonding.

1.3 REFERENCES

A. NEMA Standards.

B. NFPA 70 N.E.C. Latest Edition.

C. U.L. Standards.

1.4 PERFORMANCE REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70 (N.E.C.).

B. Furnish products listed and classified by Underwriters Laboratories, Inc. (U.L.) as suitable for purpose specified and shown.

C. NFPA 70E Requirements from manufacturer
1. Include Short Circuit and Coordination study. Incorporate information from pad mounted transformers into the report.
2. Based on the available short circuit and the fault clearing time, the distribution system components, shall limit the incident energy such that the PPE Hazard/Risk Category is 1.
3. Select distribution system components, and make adjustments as required to meet this criteria.
4. Provide Hazard Warning Label on equipment.
5. See also Article “SUBMITTALS”

D. Surge Protective Device (SPD) minimum standards: IEEE C62.41& IEEE C62.45, NEMA LS 1, UL 1449 third edition or current edition, UL 1283, NEC 285. The SPD shall be installed on the load side of an overcurrent protective device unless provided with integral overcurrent protection. IEEE C62.41 Category C for main service locations, Category B for distribution and branch panel locations, and Category A when mounted at the load. The peak single-impulse ratings for SPD shall be 300KA per phase for Category C location (UL1449 Type 1 or 2), 160KA per phase for Category B location (UL1449 Type 2), and 100KA per phase for Category A location (UL1449 Type 3). Provide Surge Protective Devices where indicated on Drawings.

1.5 SUBMITTALS

A. Submit Shop Drawings, Owners' Manuals, and Operating Instructions in accordance with Division 01 Section "Submittal Procedures."

B. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement, catalog, specification and sizes, panel dimensions, and gutter space.

C. Include coordination study with recommended breaker settings and fault current and arc flash hazard analysis showing compliance for the AIC requirements.

D. Include calculations and details of selected components to confirm compliance with the NFPA 70E criteria. Provide completed labels with following details.

1. Include Completed Hazard Warning Labels To Read As Follows:
   ! Warning; Arc Flash and Shock Hazard.
   Appropriate PPE Required.
   Failure To Comply Can Result In Death or Injury.
   Refer to NFPA 70E.
   Flash Hazard Boundary: ____inch;
   Flash Hazard at 18 in. : ____Cal/cm^2
   Category ___; PPE Description _____.
   Clove Class: ____.
   Voltage: Shock Hazard when cover is removed.
   Limited Approach: ____inch.
   Restricted Approach: ____inch.
   Prohibited Approach: ____inch.
2. Located on each panel per NEC Art. 110.16

1.6 SPARE PARTS

A. Keys: Furnish to Owner 1 key for each panel. All panels shall be keyed alike or to Owners keying system. Minimum 5 keys.

B. Fuses: Furnish to Owner three (3) spare fuses for each circuit and each device specified with fuses. Maximum of six (6) spare fuses of each type and rating installed.

C. Fuse Pullers: Furnish one fuse puller to Owner.

D. Fuse Cabinet: Sized to contain all spare fuses required plus 25% room for future use. Provide with engraved nameplate.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURES - PANELBOARDS

A. Eaton/Cutler-Hammer.

B. I-T-E Siemens.

C. General Electric.

D. Square D.

2.2 MAIN AND DISTRIBUTION PANELBOARDS RATED 400AMPERE AND OVER

A. Panelboards:
1. Circuit breaker type with mains and circuits as indicated on the Drawings and designed for three phase, four wire, solid neutral, 60 cycle service rated for 120/208 volt service as scheduled.
2. Main Panelboard: U.L. labeled for use as service entrance equipment.

B. Enclosure: NEMA Type 1 except as noted. Code gauge galvanized steel boxes and enameled steel fronts, door-in-door trim, sized for 6" minimum side, top and bottom gutters, or greater as required by NEC.

C. Bus: Copper, ratings as scheduled on Drawings. Lugs designed for use for both copper and aluminum conductors.

D. Neutral Bar: Full size insulated from the cabinet and provided with lugs as required to receive the conductors indicated and specified. At service entrance panels, provide with bonding jumper.

E. Bonding strap securely attached to the cabinet with lugs as required to receive the bonding conductors indicated and specified.

F. Molded Case Circuit Breakers:
1. Unless indicated otherwise on the drawing schedules, main and branch breakers shall be fully rated for a minimum interrupting rating of 42,000 AIC at 240 volts and shall be fully coordinated with branch breakers.
2. Branch breakers up to 400 amp rating shall be designed to protect 10,000 AIC, 15A to 400 amp downstream breakers on faults up to 42,000 RMS symmetrical amperes using current limiting type design to clear a fault in less than 1/4 cycle without the use of current limiting fuses. Branch breakers scheduled in excess of 400 amps may incorporate integral current limiting fuses with anti-single phasing to protect downstream breakers.
3. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

2.3 PANELBOARDS RATED LESS THAN 400AMPERE

A. Circuit breaker type with mains and circuits as indicated on the Drawings and all designed for three phase, four wire, solid neutral, 60 cycle service rated for 120/208 volt service as scheduled.

B. Enclosure: NEMA Type 1 except as noted. Code gauge galvanized steel boxes and enameled

steel fronts, with door-in-door trim, sized for 6" minimum side, top and bottom gutters, or greater as required by NEC. Flush or surface mounting as indicated by the panel schedule, concealed hinge and flush lock all keyed alike.

C. Bus: Copper ratings as scheduled on Drawings. Provide sub-feed and feed-through lugs as required. Lugs designed for use for both copper and aluminum conductors. Sub-feed shall signify that lugs are tapped ahead of buses and feed-through shall signify that lugs are tapped on load side of the main and buses.

D. Neutral Bar: Copper, full size insulated from the cabinet and provided with lugs for each branch circuit space in the panel.

E. Bonding strap securely attached to the cabinet with lugs as required to receive the bonding conductors indicated and specified.

F. Unless indicated otherwise on the drawing schedules, Minimum Integrated Short Circuit Rating:
1. 10,000 amperes rms symmetrical at 240 volt for 120/208V panels served by a dry type transformer rated 75 KVA or less.
2. 22,000 amperes rms symmetrical at 240 volt for 120/208V panels served by a dry type transformer rated greater than 75 KVA.
3. 22,000 amperes rms symmetrical at 240 volt for 120/208V panels located within 25’ of the main service panel.

G. Molded Case Circuit Breakers: Toggle type thermal-magnetic, quick-make, quick-break, with silver-plated contacts, bolt-in type, and with common trip for multiple circuits. Breakers shall have a nominal thickness of 1" per pole. Provide circuit breakers UL listed as Type SWD for switching lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where indicated.

2.4 INDIVIDUALLY MOUNTED CIRCUIT BREAKERS

A. Circuit Breakers as Main: U.L. labeled for use as service entrance equipment. Breakers shall be fully rated for a minimum interrupting rating of 42,000 AIC at 240 volts and shall be designed to protect 10,000 AIC, 15-400 amp downstream breakers on faults up to 42,000 RMS symmetrical amperes using current limiting type design to clear a fault in less than 1/4 cycle without the use of current limiting fuses. Branch breakers scheduled in excess of 400 amps may incorporate integral current limiting fuses with anti-single phasing to protect downstream breakers.

B. Molded Case Circuit Breakers: As specified above for Panelboards.

C. Enclosure: NEMA Type 1 general purpose except as noted.

D. Flush or surface mounted as indicated.

2.5 ACCEPTABLE MANUFACTURERS - FUSES

A. Buss or equal.

2.6 FUSES

A. Fuses 600 Amperes and Less: Dual element, current limiting, time delay, 600 volt, UL Class J.

B. Fuses 601 Amperes and Larger: Current limiting, time delay 600volt, UL Class L.

C. Interrupting Rating: 200,000 rms amperes.

2.7 EXTERNALLY MOUNTED SPD

A. ACCEPTABLE MANUFACTURERS
1. Current Technology.
2. Emerson Network Power; Liebert.
3. Panel board manufacturer.

B. Provide SPD either integral to panelboards in an isolated compartment, a panelboard enclosure extension or external to the panelboard with the shortest conductor lengths possible for any of the above points of installation. Five feet or less length of phase conductor, neutral and ground conductors is desired) If longer wire length is required install SPD with low impedance high performance interconnect (HPI) cable. SPD Vendor shall supply the HPI cable. Installer must inform SPD manufacturer of HPI cable lead length needed but length shall not exceed 30'.

C. Rated voltage designed for panel served: 120/208 VAC 3 phase, 4 wire plus ground.

D. Suppression Response: ANSI/IEEE C62.41 Category A & B & C for locations served.

E. Voltage Protective Rating (VPR) shall be stated and marked on SPD.

F. UL Standard 1449 3rd Edition or current edition with Type Category shall be marked on the SPD.

G. EMI/RFI Noise Filtering: Provide with noise filter per UL-1283, mark UL-1283 compliance on SPD.

H. UL1449 Nominal Discharge Surge Current Rating (I-n) shall be 20KA at main service, distribution and branch panel locations. Point of use locations may be 10KA. The Nominal Discharge Surge Current Rating shall be on the nameplate of the SPD.

I. The SPD shall be a seven (7) mode device: 3 x L-N, 3 x L-G, and N-G.

J. Main Switchboards and Main Panels rated 400 Amperes and over: Design performance basis Current Technology TG3 Series or equivalent.
1. Max Surge Current per phase/per mode: 300KA/150KA
2. Internal suppression module or modules must be replaceable at Main Service locations (modular construction).
3. UL1283 electrical noise filter.
4. Internal combination thermal and surge rated fusing. 200KAIC.
5. Audible alarm.
6. Alarm re-set feature.
7. Digital Surge Counter.
8. LED Phase Status indication: Green > 75% protection, Orange 40-75% protection, Red < 40% protection. Orange or Red led status shall be the basis for warranty claim.
9. Dry Contacts for remote monitoring.
10. The SPD shall be connected to a minimum 100A circuit breaker in the main panel.
11. NEMA 4 or 12 Enclosure.
12. Safety Barrier over electrical connections.

13. 15 year SPD Mfg. warranty.

K. Distribution and branch panelboard locations: Design performance basis Current Technology CGP Series or equivalent.
1. Max Surge Current per phase/per mode: 160KA/80kA.
2. Non Modular construction acceptable for these locations.
3. UL1283 electrical noise filter.
4. Internal combination thermal and surge rated fusing. 200KAIC.
5. Audible alarm.
6. Alarm re-set feature.
7. Digital Surge Counter.
8. LED Phase Status indication: Green acceptable, red failure.
9. Dry Contacts for remote monitoring.
10. The SPD shall be connected to a minimum 60A circuit breaker in the panel.
11. NEMA 4 or 12 Enclosure.
12. 15 year SPD Mfg. warranty.

2.8 METERING

A. Main Panelboard shall have a totally self-contained microprocessor based metering system as follows: Electro Industries: Shark 200 Data Logging Power Meter/Transducer (no exceptions)
1. Provide two units as follows: Shark 200-60-10-V2-D2-INP100S-P01S-X, both units shall be mounted in the same Nema-1 enclosure, nippled to panel MDP.
2. Basic Features Summary:
a. 0.2% Class Revenue Certifiable Energy and Demand Metering.
b. Meets ANSI C12.20 and IEC 62053-22 (0.2% Class).
c. Multifunction Measurement.
d. 3 Line .56” LED display and % of Load Bar for Analog Perception.
e. 0.001 HZ Frequency Measurement for Generating Stations.
f. Standard RS485 (Modbus and DNP 3.0)
g. IrDA Port Enables Laptop PC Reading and Programming.
h. Ultra-Compact.
i. Fits both ANSI and DIN Cutouts.
3. Advanced Features Summary
a. High Performance Waveform Recorder.
b. Up to 4 Megabytes Flash for Historical Data Logging & PQ Recording.
c. Extremely Configurable Field Upgradable I/O.
d. 100BaseT Ethernet – Rapid Response® Technology.
e. V-Switch® Technology. (provide with V6 option)High Precision Frequency Measurement for Frequency Control.
4. Field Expandable I/O and Communication Capabilities
a. INP100S: 100BaseT Ethernet Capability, providing 100BaseT Ethernet functionality, embedded web server, Smartphone compatible, Network Time Protocol (NTP) support (Network Clock Sync), twelve (12) simultaneous Modbus TCP/IP connections, five (5) simultaneous DNP over TCP/IP connections and dual Ethernet ports.
b. P01S: Four Pulse Outputs/Four Status Inputs, programmable to any energy parameter and pulse value, with Form A; normally open contacts, also used for end of interval pulse, 120mA continuous load current, status inputs – Wet/Dry Auto Detect (up to 150 VDC), and KYZ outputs and pulse input counting.

5. Provide with NEMA-1 enclosure, CT's (with shorting block) for monitoring main panel feeders, in-line fuses, power supply, and certificate of certification.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards plumb and properly secured. Recessed panels shall be flush with wall finishes.

B. Height: Per N.E.C or as specifically indicated.

C. Provide filler plates for unused spaces in panelboards.

D. Provide typed directory completely filled-in indicating outlets, fixtures, devices, and locations served by the circuit. Revise directory to reflect circuiting changes required to balance phase loads.

E. Stub four empty one inch conduits to accessible location above, ceiling and below floor, from each recessed panelboard that has accessible ceilings above and/or below the panel.

F. Provide completed Hazard Warning Labels mounted on each panel.

G. Finish painting of flush panelboards and individually mounted breakers shall be as specified in Division 09 Section "Painting".

H. Properly support backboards, and panels. Coordinate with Division 06 Section "Rough Carpentry", to provide blocking as required.

I. Properly support backboards, and panels. At non structural walls, provide separate support system for panelboards and equipment. Use UNISTRUT P5000 channels or equal. Length and spacing to form rigid separate wall. In other areas, coordinate with Division 06 Section "Rough Carpentry", to provide blocking as required.

3.2 FIELD QUALITY CONTROL

A. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.

B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

3.3 WARNING

A. Provide Label on exterior of all panels served by the generator: "Warning Panel is Served by Two Sources (Emergency & Normal). Both Sources Shall Be Locked OFF Before Servicing."

3.4 PANELBOARD SCHEDULE

A. See Drawings.

END OF SECTION 260470

SECTION 260510 – LUMINAIRES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Interior and exterior luminaires and accessories.

B. Dimming Ballasts and Drivers

C. Additional wiring methods for luminaires.

1.2 RELATED SECTIONS

A. Division 26 Section 260010: Basic Electrical Requirements.

B. Division 26 Section 260111: Conduit.

C. Division 26 Section 260123: Wire and Cable.

D. Division 26 Section 260130: Boxes.

E. Division 26 Section 260170: Grounding and Bonding.

F. Division 26 Section 260141: Wiring Devices. (for self contained local controls)

1.3 REFERENCES

A. NEMA Standards.

B. NFPA 70 N.E.C. Latest Edition.

C. U.L. Standards.

D. ANSI/NFPA 101 - Life Safety Code.

1.4 PERFORMANCE REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70 (N.E.C.).

B. Furnish products listed and classified by Underwriters' Laboratories, Inc. (U.L.) as suitable for purpose specified and shown.

1.5 SUBMITTALS

A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section “Submittal Procedures”.

B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

C. Product Data: Provide dimensions, ratings, performance data and total input watts.

D. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site. Inspect for damage.

B. Protect from moisture, corrosion and entrance of debris by storing above grade. Provide appropriate covering.

1.7 SPARES

A. Provide replacement ballasts/drivers for each ballast/driver type installed as follows:
   1. 1% of total ballasts/drivers per type installed.
   2. Minimum of 2 ballasts/drivers for each type installed.

1.8 PROJECT CONDITIONS

A. Wiring to fixtures as shown on Drawings is diagrammatic only and is intended to show circuit and switching arrangements. Fixtures shall not be used as raceways except as specifically allowed by N.E.C. Art 410.

B. Where panel designation and circuit numbers are shown with no homerun symbol, wiring to same circuits may share same homerun to panel.

PART 2 - PRODUCTS

2.1 LUMINAIRES

A. Furnish products as specified in schedule on Drawings.

B. All fixtures shall be approved by Underwriters' Laboratories, Inc., and bear Underwriters' labels.

C. In addition to the manufacturers listed on the Drawings, fixtures with equivalent details and matching characteristics may be considered for approval after review of Shop Drawings. See substitution process in Section 016300 “Substitutions and Product Options”.

D. Ballast: Provide ballast suitable for lamp specified.

E. Lamps: All lamps shall be furnished and installed in each fixture.

2.2 BALLASTS/DRIVERS: Rated 120/277 volts or as noted.

A. LED Dimming Driver:
   1. Equal to Advance Xitanium (0-10V).
   2. Fully electronic designed to operate properly on the LED sources indicated. Coordinate

with LED manufacturer for compatibility.

3. Drivers shall have a Class A sound rating.
4. Dimming shall be controlled by a Class 1 or Class 2 low-voltage 0-10V circuit.
5. Driver shall operate LEDs at a frequency of 60 Hz.
6. Drivers shall operate from 50/60 Hz input source of 120V or 277V with sustained variations of +/- 10% (voltage and frequency) with no damage to the drive..
7. Driver shall have a Power Factor greater than 90% and the input current shall have Total Harmonic Distortion (THD) of less than 20%.
8. Driver shall tolerate sustained open circuit and short circuit output conditions without damage and without need for external fuses or trip devices.
9. Driver shall have a minimum operating temperature of -40C (-40F).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fixtures: Complete with wiring, ballasts/drivers, stems, hangers, fittings, end plates, etc.

B. Install in accordance with manufacturer's instructions.

C. Suspended Luminaires.
   1. Pendants:
      a. Provide pendant/chain length required to suspend luminaire at indicated height. Cut or lengthened to give mounting heights as indicated and required.
      b. Where fixtures are specifically indicated to be chain mounted, provide wire hook chain set & jack chains cut to length as required to suspend luminaire at indicated height. Use MC cable supported by cable ties from fixture to junction box mounted in structure above each fixture.
      c. Except as specifically noted, fixtures shall be supported from structural steel. Provide unistrut channels or equal to span between top cord of joists. Supports shall be suitable for fixture weight and seismic forces.
      d. Pendant suspension details shall be submitted for approval prior to installation.

D. Provide 12 gauge safety hanger wire supports for all fixtures recessed in ceiling grids of suspended acoustical ceilings. Hangers shall be independent of ceiling framing suspension system and shall extend from fixture housing to structure above. Lighting fixtures weighing less than 56 pounds shall have two hangers, at diagonal corners of fixture (2 locations). Lighting fixtures weighing more than 56 pounds shall have four hangers, one at each corner of fixture (4 locations). Wires shall have no tension (slack) to prevent ceiling distortion. In addition, attach to ceiling framing “T”s as required by code.

E. Fixtures with one (1) piece 8' channel shall be supported within two feet (2') of each end and fixtures with 4' channel shall be supported within one foot (1') of each end. Fixtures indicated in continuous rows shall have ends bolted together and shall be provided with 4' long lens constructed so the joint between two (2) sections of an 8' fixture appear the same as two (2) 4' fixtures butted together.

F. Locate recessed ceiling luminaires as indicated on reflected ceiling plan. Fixtures shall have frame and trim details to match the ceiling suspension system furnished. Coordinate details with

Acoustical Treatment Section and installation with the Ceiling Installer to assure fixtures are centered on tiles or on joints as required.

G. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Install spacers where required to allow proper installation of rabbeted (Tegular) ceiling tiles. Secure to prevent movement.

H. Install clips to secure recessed luminaires in place. Install recessed luminaires to permit removal from below.

I. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

J. Install wall mounted luminaires at height as indicated.

K. Install accessories furnished with each luminaire.

L. Additional Wiring Methods For Luminaires:
1. Refer to Division 26 Section 260010 - Basic Electrical Requirements: Performance Requirements.
2. Refer to Division 26 Section 260123 - Wire and Cable: Wiring Methods.
3. Recessed and surface incandescent fixtures: Wiring rated minimum 300°F in metallic conduit where required for Underwriters' approval.
4. Fluorescent Fixtures: Wiring within housings and between fixtures and junction boxes above ceilings shall be Type THHN insulated conductors rated for use at temperatures not lower than 90ºC.
5. Wiring From Recessed Fixtures To Junction Boxes: As described in Division 26 Section 260010 “Basic Electrical Requirements”: Performance Requirements.

M. Bond products and metal accessories to branch circuit equipment grounding conductor.

N. Install specified lamps in each luminaire.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Locate fixtures to avoid interference with mechanical and structural features.

B. In finished spaces, consult the Architect prior to making adjustment to fixture locations.

3.3 FIELD QUALITY CONTROL

A. All fixtures and equipment shall be in first-class condition at time of delivery of building to Owners with all scratches, mars, etc., refinished to factory standards.

B. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.4 ADJUSTING/CLEANING/RELAMPING

A. Aim and adjust luminaires after dark as directed.

B. Relamp luminaires whose lamps have failed at Substantial Completion and six (6) months thereafter.

C. Clean electrical parts to remove conductive and deleterious materials.

D. Remove dirt and debris from enclosure.

E. Clean photometric control surfaces using procedures as recommended by manufacturer.

F. Clean finishes and touch up damage.

3.5 SCHEDULE

A. Shown on Drawings.

END OF SECTION 260510

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SECTION 260535 – EMERGENCY LIGHTING EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Emergency lighting battery units.

B. Exit signs.

1.2 RELATED WORK

A. Section 260010: Basic Electrical Requirements.

B. Section 260111: Conduit.

C. Section 260123: Wire and Cable.

D. Section 260130: Boxes.

E. Section 260170: Grounding and Bonding.

F. Section 260510: Luminaires.

1.3 REFERENCES

A. NEMA Standards.

B. NFPA 70 (N.E.C.) Latest Edition.

C. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures.

D. U.L. Standards.

E. ANSI Standards.

1.4 DESIGN REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.(N.E.C.)

B. Conform to local building code and NFPA 101 for installation requirements.

C. Furnish products listed and classified by Underwriters Laboratories, Inc. (U.L.) as suitable for purpose specified and shown.

D. All components of the same manufacturer.

1.5 SUBMITTALS

A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section "Submittal Procedures."

B. Include all components, electrical characteristics, recommended maintenance procedures and intervals, list of each battery unit and the total device count and load on each unit.

C. Submit manufacturer's instructions.

1.6 WARRANTY

A. Fully guaranteed for a minimum of three (3) years. Except as noted, batteries shall be warranted for an additional seven (7) years minimum, on a prorated basis with a life expectancy of ten (10) years.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Dual-Lite: Model numbers listed except as noted.

B. Sure-Lites.

C. Chloride.

D. Lithonia.

E. Substitutions: Under provisions of Division 01.

2.2 EMERGENCY LIGHTING BATTERY UNITS

A. Fully automatic, 90 minute operation, compact low-profile design. Injection molded, flame-rated, thermoplastic housing with universal mounting plate. Self-contained lamp and battery package.
   1. 120/277 VAC operation.
   2. Maintenance-free lead acid battery, 10 year warranty (5 years full, 5 years pro-rata).
   3. Two 7.2-watt, 6-volt incandescent sealed-beam lamps.
   4. Fully-automatic solid state electronics.
   5. Integral test switch.
   6. Built-in protection: AC lockout, transformer isolation, low battery voltage disconnect, brownout protection and 15 minute retransfer delay.
   7. LED indicators for “Service Alert” and “Operating Status” and visual faults indicators for battery, charger, transfer and lamp faults.
   8. Manual Tests: Test switch allows a programmable 1, 5, 30 or 60 minute system check at any time.
   9. UL924 Listed (emergency Lighting)
   10. Dual-Lite: EZ-2 Series.

B. Remote Heads: provide remote heads where indicated on Drawings with features similar to unit mounted heads. In exterior locations provide weatherproof assembly.

C. Batteries: Sufficient capacity to supply and maintain at not less than 87-1/2 percent of system voltage the total lamp load indicated for a period of time as required by latest edition of NEC,(90 minutes minimum). Initially oversize to meet this criteria over battery's entire life.

2.3 EXIT SIGNS

A. Universal LED type self-powered, complete with ceiling, side wall brackets and arrows and faces as indicated. Brown out, low voltage disconnect, test switch, power indicator.

B. Precision-molded thermoplastic construction white face and red letters.

C. Red LED's smooth look and no visible LED dots. Less than 3Watts input power.

D. Nickel Cadmium Battery with 15 year pro rated warranty.

E. Dual-Lite LX Series.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units plumb and level.

B. Aim directional lamp heads to maximize light in egress paths and as directed.

C. AC Wiring to Exit Lights: In separate conduit, or MC cable (depending on location).

D. Exit Sign Mounting: Generally mount directly above and centered over the doorway opening, on the wall where possible, or mounted from the ceiling when wall mounting is not possible. End wall mounted where required, up 7'-6" AFF. The intent is to locate signs to allow for maximum visibility. Consult Architect before installation, if in question.

END OF SECTION 260535

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SECTION 260721 – FIRE ALARM SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Complete Addressable Fire Alarm System including but not limited to:
   1. Equipment, materials, labor, installation, connection, programming, testing, training and performance of all operations of the intelligent reporting fire alarm system as indicated on the drawings and as herein specified.
   2. Alarm initiating devices, alarm notification appliances, fire alarm control panel (FACP), auxiliary control devices, annunciators, and wiring.
   3. ONYXWorks gateway to report Fire alarm events to send point specific information to the Gorham Campus Onywworks system located at the campus police department. Provide with all programming required.

1.2 RELATED SECTIONS

A. Section 260010 - Basic Electrical Requirements.

1.3 REFERENCES

A. NFPA 70 (N.E.C.) latest edition.

B. U.L. Standards.

C. FM Factory Mutual

D. NFPA 72 National Fire Alarm Code.

E. ADA - Americans with Disabilities Act.

F. NFPA 101 - Life Safety Code.

G. Local and State Codes.

H. Portland Fire Department - Rules & Regulations for the Installation of Fire Alarm Systems.

1.4 PERFORMANCE REQUIREMENTS

A. Conform to requirements of NFPA 70. (N.E.C.), specifically Art 760.

B. Conform to requirements of the National Fire Protection Association, Standards NFPA 72, NFPA 101 and also all applicable Federal, State and local codes.

C. All requirements of the Authority Having Jurisdiction (AHJ).

D. All components of the same manufacturer, FM approved and listed by Underwriters' Laboratories, Inc., and so labeled.

E. Furnish products listed and classified by Underwriters' Laboratories, Inc. (U.L.) as suitable for purpose specified and shown. The fire alarm control panel, network interface and all transponders shall meet the modular labeling requirements of U.L. Each subassembly, including all printed circuits, shall include U.L. modular labels.

F. Include all necessary software, programming and the selection of the proper type and quantities of the system components to assure a complete, operational, and Code Compliant System.

G. System shall be completely field programmable.
   1. Provide the Owner with all required components, interfaces and passwords to allow them full access to the programming features. Provide minimum of 8 hours on site training on programming features.
   2. Provide all hardware, software, programming tools, and documentation necessary to allow modifying the fire alarm network on site. Modifications include addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices and zones.
   3. The system structure and software shall place no limit on the type and extent of ON-SITE software modifications. Software modification shall not require power shut down of system and shall not cause loss of system fire protection while making modifications.

H. Special Programmable Features:
   1. HVAC units: Interface shall be field programmable to allow activation on general alarm and/or on selective zoning of local detectors. Set initially to shut down on general alarm, plus send status signal to the Energy Management/Temperature Control system (ATC) provided under Div. 23. For all HVAC equipment that is required to be shut down upon a fire alarm condition, ensure that fire alarm shutdown of equipment is wired through input contacts within the starter enclosure. Upon receipt of a signal from the building's fire alarm system, power to the load side of the starter shall be turned off. Circuitry shall be provided to ensure that power is off whether the starter is in the "AUTO", "HAND" or "BYPASS" mode. If this feature is not available from the starter manufacturer, division 23 shall be responsible for providing a contactor on the line side of the starter to accomplish the same function. The contactor shall meet the requirements specified under this division.

I. The drawings do not show all details of the Fire Alarm System. It shall be the responsibility of the authorized supplier/installer to provide a fully operational code compliant system.

J. Coordinate with and obtain approval from the local Fire Chief (AHJ), prior to the Shop Drawing submittal. See Item Submittals.

1.5 SYSTEM DESCRIPTION

A. Fire Alarm System: Addressable automatic and manual initiating, intelligent reporting, microprocessor controlled fire detection and audible and visual fire alarm system with network communications capabilities.

B. An active/interactive type system where each FACP is repetitively scanned, causing a signal to be transmitted to the local fire alarm control panel node indicating that the FACP and its associated initiating devices and notification appliance circuit wiring is functional. Loss of this signal at the local FACP shall result in a trouble indication on both the FACP display and at the network display.

C. System Performance and Supervision:
   1. Alarm, trouble and supervisory signals from all intelligent reporting devices: Encoded on NFPA Class A signaling line circuits (SLC).
   2. Initiating device circuits (IDC): Wired class A NFPA Style D as part of an addressable device connected by the SCL circuit (end of line returns to the panel using a separate path).
   3. Notification appliance circuits (NAC): Wired class B NFPA Style Y.
   4. Digital electronic signals: Employ check digits or multiple polling.
   5. Occurrence of single ground or open condition in initiating or signaling circuit places circuit in TROUBLE mode.
   6. Occurrence of single ground or open condition in the initiating circuit does not disable any device on that circuit.
   7. Occurrence of single ground or open condition on alarm initiating or signaling circuits does not disable that circuit from transmitting in ALARM.
   8. Component or power supply failure places system in TROUBLE mode.
   9. Alarm signals arriving at the main FACP shall not be lost following a primary power failure until the alarm signal is processed and recorded.
   10. Batteries: Under or over battery voltage, shorted or disconnected battery supply places system in TROUBLE mode.
   11. FACP devices are to consist of low current, solid-state integrated circuits, and shall be powered locally from a primary power and standby power source.
   12. Power for initiating devices and notification appliances must be from the main fire alarm control panel, the FACP to which they are connected or to a Field Charging Power Supply (FCPS).
   13. Notification appliance circuits shall have 25% spare capacity.

D. Alarm Sequence of Operation: Actuation of manual fire alarm station, automatic initiating device and sprinkler flow switches causes system to enter ALARM, which includes the following operations:
   1. Indicate location of device in alarm on the fire alarm control panel for all events.
   2. Activate audio visual devices.
   3. Transmit signals to the ONYXWorks system located at the Gorham campus police department.
   4. Provide one general alarm signal to Automatic Temperature Controls (ATC) panel, see Section 230900 – Instrumentation and Control for Mechanical Systems.
   5. Activate all programmed events.
   6. Sound and display throughout the building the fire alarm (audio/visual) signaling devices and the pre-recorded messages as required to evacuate all areas of the building.
   7. See Special Programmable Features for additional requirements.

E. Alarm Silence: The alarm horns may be silenced, after three (3) minutes, at the associated locked control cabinet. Alarm lights shall remain flashing until system is reset. A subsequent zone alarm shall reactivate the signals.

F. Alarm Reset: RESET function resets alarm system to NORMAL condition (out of ALARM) if alarm initiating circuits have cleared.

G. Trouble Sequence of Operation: System trouble, including grounding or open circuit of supervised circuits, or power or system failure causes system to enter TROUBLE mode, including the following operations:
   1. Visual and audible trouble alarm by zone at associated control panel.
   2. Visual and audible trouble alarm at annunciator panels.
   3. Manual ACKNOWLEDGE function (trouble silence switch) at control panel silences audible trouble alarm; visual alarm is displayed until initiating trouble is cleared.

H. The activation of any system smoke detector shall initiate an Alarm Verification operation whereby the panel resets the activated detector and waits for a second activation. If, after reset, a second alarm is reported from the same or any other smoke detector within one (1) minute the system shall process the alarm. If no second alarm occurs within one minute the system shall resume normal operations. The Alarm Verification shall operate only for smoke detectors. Other activated initiating devices shall be processed immediately.

I. Zoning: Programmable, initially set up so that each device has a separate and distinct address. Provide labor to change device label as direct by Owner and Fire Department.

1.6 QUALIFICATIONS

A. Fire alarm equipment Manufacturer:
   1. Company specializing in manufacturing the products specified in this Section with minimum five years documented experience.
   2. Company maintaining engineering and service departments capable of rendering advice regarding installation and final adjustment of the system.

B. Supplier/Installer (Vendor):
   1. Company authorized by the manufacturer and specializing in fire alarm systems with minimum five years experience.
   2. Company shall employ NICET (minimum Level II fire alarm technology) technicians.
   3. Provide the services of a factory trained and certified representative or technician, experienced in the installation and operation of the type of system provided.
   4. The technician shall supervise installation, software documentation, adjustment, preliminary testing, final testing and certification of the system. The technician shall provide the required instruction to the owner's personnel in the system operation and maintenance.
   5. The equipment supplier shall be authorized and trained by the manufacturer to calculate, design, install, test, and maintain the system.
   6. Company offering service contracts for continuing factory authorized service after the initial warranty period.

1.7 SUBMITTALS

A. Prior to submitting Shop Drawings to the Architect, set up a meeting at the Local Fire Department with a complete submittal package. Meeting shall include the Fire Chief, Assistant Fire Chief, and, System Vendor. Vendor shall present the proposed system to the Fire Department and describe in detail, the operation. Once the fire department is satisfied that the

proposed system satisfies their requirement (including locations of ADA required Strobes), then the shop drawings may be submitted to the Architect along with a copy of the minutes of the meeting. Shop drawings will not be reviewed by the Architect without this presentation and minutes of the meeting.

B. Include floor plans showing all devices, wiring, and connections: Plan layout, connection diagrams and catalog cuts of all components. Use 1" = 20' composite contract drawing for shop drawing purposes and shall be marked-up showing all wiring between devices, number of conductors, and labeling system. Shop drawings will not be reviewed by the Architect without these drawings.

C. Include proposed wiring color code and verification that it meets local fire department standards.

D. Include narrative description of system functions and sequence of operation.

E. Include catalog cuts of all equipment, devices, annunciator layout, control panel modules, and internal terminal configurations.

F. Include documentation showing proof of U.L. listing for all system components.

G. Include System Power Supply Requirements:
   1. Total panel supervisory current.
   2. Total horn/light signal current.
   3. Total auxiliary power.
   4. Total smoke detector supervisory and alarm power.
   5. Total battery amp-hour calculations.
   6. Total power on each Field Charger/Power Supply (FCPS).
   7. Voltage drop on each notification circuit (voltage drop at each appliance).

H. Include all cable types.

I. Include letter verifying that system has been reviewed and approved by the local Fire Department.

J. Include second year extended service contract listing services included and costs. The cost of this service contract is included under this section.

K. Submit manufacturer's instructions.

1.8 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations and mounting heights of outlets if not as shown on Drawings, plus pull and junction boxes larger than 12x12x6 inches.

B. Accurately record actual routing of conduits larger than 1 inch and main wiring trunks.

1.9 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data.

B. Include spare parts data listing; source and current prices of replacement parts and supplies; and

recommended maintenance procedures and intervals.

C. Include operating instructions, and maintenance and repair procedures.

D. Include manufacturer's representative's letter stating that system has been tested and is operational. Use NFPA 72 FIRE ALARM SYSTEM CERTIFICATION and DESCRIPTION form.

1.10 EXTRA MATERIALS

A. Provide two manual pull stations.

B. Provide two keys of each type.

C. Provide one smoke detector of each type used on Project.

D. Provide one heat detector of each type used on Project.

E. Provide one audio/visual appliance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Notifier: Addressable system. Model numbers used except as noted.

B. No substitutions.

2.2 FIRE ALARM CONTROL PANEL

A. Fire alarm control panel shall be Notifier Model NFS-320. Provide all necessary modules for a complete operational system as specified herein. Panel shall include a microprocessor based central processing unit (CPU). The FACP shall communicate with and control the following types of equipment used to make up the system: intelligent detectors, addressable modules, transponders, local and remote operator terminals, printers, annunciators, and other system controlled devices. System shall include the ONYXWorks Gateway NFN-GW-EM-3 fire monitoring interface with IP connection.

B. FACP shall perform the following functions:
   1. Supervise and monitor all intelligent/addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
   2. Supervise all signaling and notification circuits throughout the facility.
   3. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed.
   4. Visually and audibly annunciate any trouble, supervisory or alarm, condition on operator’s terminal, panel display, and annunciators.

C. Capacity and General Operation:
   1. The loop shall be capable of 318 intelligent addressable devices. System capable of 1 loop.

2. FACP shall include a full featured operator interface control and annunciation panel which shall include a backlit Liquid Crystal Display (LCD), individual, color coded system status LED's and an alpha-numeric keypad for field programming and control of the fire alarm system.
3. FACP shall provide the following features:

Block Acknowledge	Printer Interface
Charger rate control	CRT Display Interference
Control-by-time	Non-Alarm Module Reporting
Day/Night Sensitivity	Periodic Detector Test
Device Blink Control	Remote Page
Drift Compensation	Trouble Reminder
NFPA 72, Sensitivity Test	Upload/Download to PC Computer
System Status Reports	Verification Counters
Security Monitor Points	Walk Test
Alarm Verification	Maintenance Alert

D. Central Processing Unit (CPU):
1. FACP shall include a central processing unit. The CPU shall communicate with, monitor, and control all other modules within the control panel. Removal, disconnection or failure of any control panel module shall be detected and reported to the system display by the CPU.
2. Each CPU shall contain and execute all control-by-event interlock for specific local and network action to be taken if an alarm condition is detected by the system. Control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.
3. The central processing unit shall also provide a real-time clock for time annotation of all system displays. The time-of-day and date shall not be lost if system primary and secondary power supplies fail.

E. Signaling Line Circuits (SLC):
1. The system shall include one SLC circuit. The SLC interface shall provide power to and communicate with up to 159 intelligent detectors (ionization, photoelectric or thermal) and 159 intelligent modules (monitor or control) for a system capacity of 318 devices. The SLC loop shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.
2. The CPU shall receive analog information from all intelligent detectors to be processed to determine whether normal, alarm, pre-alarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.
3. The detector software shall meet NFPA 72, requirements and be certified by UL as a calibrated sensitivity test instrument.
4. The detector software shall allow manual or automatic sensitivity adjustment.

F. Serial Interfaces:
1. The system shall include two serial EIA-232 interfaces. Each interface shall be a means of connecting UL Listed Information Technology Equipment (ITE) peripherals.
2. The system shall include an EIA-485 port for the serial connection of annunciators and remote LCD displays.
3. The EIA-485 interface may be used for network connection to a proprietary receiving unit.

G. Notification Appliance Circuit (NAC) power supply:
   1. The notification appliance circuit power supply shall provide four fully supervised Class A or B (NFPA Style Z or Y) notification circuits. An expansion circuit board shall allow expansion to eight circuits per module.
   2. The notification circuit capacity shall be 3.0 amperes maximum per circuit and 6.0 amperes maximum per power supply.

H. Operators Terminal: Provide the following functions in addition to any other functions required for the system:
   1. Acknowledge (ACK/STEP) Switch:
      a. Activation of the control panel Acknowledge switch in response to a single new alarm and/or trouble conditions shall silence the local panel piezo electric signal and change the system alarm or trouble conditions that exist or are detected and reported in the system, depression of this switch shall advance the 80-character LCD display to the next alarm or trouble condition.
         1) Depressing the acknowledge switch shall also silence all remote annunciator piezo sounders.
   2. Signal Silence Switch: Activation of the signal silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm activation. The selection of notification circuits and relays which are silenceable by this switch shall be fully field programmable within the confines of all applicable standards.
   3. System Reset Switch:
      a. Activation of the system reset switch shall cause all local electronically-latched initiating devices, software zones, output devices and circuits, to return to their normal condition.
      b. If an alarm condition(s) still exists, or if they occur in the system after system reset switch activation, the system shall then resound the alarm conditions.
   4. System Test Switch: Activation of the system test switch shall initiate an automatic test of all intelligent/addressable detectors in the local system. The system test shall activate the electronics in each transmission of the alarm condition from that sensor to the fire alarm control panel. The fire alarm control panel shall interpret the data from each sensor installed in the system. A report summarizing the results of this test shall be displayed automatically on the system LCD and on any CRT's or printers in the system.
   5. Alarm Activate (Drill) Switch:
      a. The Alarm Activate switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset. Drill switch shall release all door hold open device.
      b. The drill switch shall not Initiate the following: Signal to central receiving station(police station) Fan shut down.
   6. Lamp Test Switch: Activation of the lamp test switch shall sequentially turn on all LED indicators, system liquid crystal display and local piezo signal, and then automatically return the fire alarm control panel to the previous condition.

I. Field Programming:
   1. The system shall be programmable, configurable and expandable in the field without the need for special tools or electronic equipment and shall not require field replacement of electronic integrated circuits.
   2. All local FACP node programming shall be accomplished through the FACP keyboard or through the video display terminal.
   3. All field defined programs shall be stored in non-volatile memory.

4. The programming function shall be enabled with a password that may be defined specifically for the system when it is installed. Two levels of password protection shall be provided in addition to a key-lock cabinet. One level is used for status level changes such as zone disable or manual ON/OFF commands. A second (higher-level) is used for actual change of program information. Passwords shall be made available to authorized personnel upon system acceptance.

J. Specific System Operations:
   1. Smoke Detector Sensitivity Adjust: Means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the FACP node from each system keypad. Sensitivity range shall be within allowed UL limits and have a minimum of nine (9) levels.
   2. Alarm Verification: Each of the intelligent addressable detectors in the system may be independently selected and enabled for alarm verification. Each FACP shall keep a count of the number of times each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.
   3. System Point Operations:
      a. All devices in the FACP node may be enabled or disabled through the local keypad.
      b. Any FACP node output point may be turned on or off from the local system keypad.
   4. Point Read: The FACP node shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point shall be annunciated for the parameters listed:
      a. Device Status.
      b. Device Type.
      c. Custom Device Label.
      d. Device Zone Assignments.
      e. View analog detector values.
      f. All Program Parameters
   5. System Status Reports: Upon command from a password-authorized operator of the system, a status report will be generated, and printed, listing all local FACP system status.
   6. System History Recording and Reporting: Each FACP node shall contain a history buffer that shall be capable of storing a minimum of 800 system events in nonvolatile memory plus separate 200-event alarm only file. Each local activation will be stored and time and date stamped with the actual time of the activation, until an operator requests that the contents be either displayed or printed. The contents of the history buffer may be manually reviewed, one event at a time, and the actual number of activations may also be displayed and/or printed. The history buffer shall use non-volatile memory.
   7. Automatic Detector Maintenance Alert: Each FACP node shall automatically interrogate each intelligent system detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is below or above normal limits, then the system will enter the trouble mode, and the particular intelligent detector will be annunciated on the system display, network display and printed on the optional system printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.

2.3 SYSTEM COMPONENTS - CONVENTIONAL

A. Horn/Strobes: Combination Audible/Visible signals shall be similar to Wheelock Exceder series.

1. Peak sound output: 99 dBA. Three adjustable ranges of 99, 95, 90dB (UL Anechoic).
2. Ability to silence the horn while leaving the visible signal active.
3. Capable of meeting the candela requirements of ADA.
4. Polarized to allow electrical supervision.
5. Candela ratings: Selectable 15, 30, 75, 110, 135, 185 with visual indicator.
6. Set initially as shown on drawings. Where drawings show 15/75, then use a fixed 15/75 or set selection at 75.
7. Provide unit that allows for audible signal.
8. Red face plate with white letters.

B. Strobe lights shall be similar to Wheelock Exceder and shall meet the requirements of the ADA, UL Standard 1971 and shall meet the following criteria:
1. The maximum pulse duration shall be 2/10 of one second.
2. Strobe intensity shall meet the requirements of UL 1971.
3. The flash rate shall meet the requirements of UL 1971.
4. Where more than one strobe is visible in one location, synchronization shall be required.
5. Candela ratings: Selectable 15, 30, 75, 110, 135, 185 with visual indicator.
6. Set initially as shown on drawings. Where drawings show 15/75, then use a fixed 15/75 or set selection at 75.
7. Red face plate with white letters.

2.4 SYSTEM COMPONENTS - INTELLIGENT

A. Addressable Devices - General:
1. Addressable devices shall maintain decade (numbered 0 to 15 and 0 to 9) type address switches.
2. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the FACP signaling line circuit.
3. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LED's. Both LED’s shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LED’s shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.
4. Smoke detector sensitivity shall be set in the fire alarm control panel and shall be adjustable in the field through the field programming of the system. Sensitivity may be automatically adjusted by the panel on a time-of-day basis.
5. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 7.
6. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature.
7. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
8. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).

9. Detectors shall operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.
10. Addressable devices shall provide address-setting means using decimal switches and shall also store use to identify the type of device. LED(s) shall be provided that shall flash under normal conditions, indicating that the device is operational and is in regular communication with the control panel.
11. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.

B. Addressable Pull Box (Manual Station):
1. Addressable pull boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. Manual stations shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters.
4. Stations shall be suitable for surface mounting or semiflush mounting as shown on the plans, and shall be installed not less than 42 inches, nor more than 48 inches above the finished floor.
5. Manual boxes shall be the double action type.

C. Intelligent Photoelectric Smoke Detector: The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

D. Intelligent Thermal Detectors: Thermal detectors shall be intelligent addressable devices rated at 135degrees F. (58 degrees C.) And have a rate-of-rise element rated at 15degrees F. (9.4degrees C.) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.

E. Addressable Dry Contact Monitor Module (FMM): shown on drawings as AMM (Addressable Monitor Module).
1. Addressable monitor modules shall be provided to connect supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLC loops.
2. The monitor module shall mount in a 4-inch square, 2-1/8 inch deep electrical box.
3. The IDC zone may be wire for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

F. Addressable Control Module (FCM):shown on drawings as ARM (Addressable Relay Module
1. Addressable control module shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual

notification appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contact relay.

2. The control module shall mount in a standard 4-inch square, 2-1/8 inch deep electrical box, or to a surface mounted backbox.
3. The control module NAC may be wired for Style Z or Style Y (Class A/B) with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation, or as a dry contact (Form-C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to ensure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.
4. Audio/visual power shall be provided by a separate supervised power loop from the main fire alarm control panel or from a supervised, UL listed remote power supply.
5. The control module shall be suitable for pilot duty applications and rated for a minimum of .6 amps at 30 VDC.

G. LCD Alphanumeric Display Annunciator (within panel):

1. The alphanumeric display annunciator shall be a supervised, back-lit LCD display containing a minimum of 80 characters for alarm annunciation in clear English text.
2. The LCD annunciator shall display all alarm and trouble conditions.

2.5 BATTERIES

A. Sealed lead calcium type capable of operation of the system under supervisory conditions for a minimum of 60 hours after power failure and capable of operating the alarm devices for 15 minutes during the 60 hour period. IF batteries do not fit in control panels, then remotely mount in battery cabinet in nearest storage/mech room.

2.6 AUXILIARY DEVICES

A. Provide and install interface relays with number of poles as required (in no event less than three poles). Relays shall be Allen-Bradley, or approved equal, Bulletin 700, Type "BR" series, 120 volt coil in NEMA I enclosures. Paint enclosure red and mark "Fire Alarm Relay."

2.7 FIELD CHARGING POWER SUPPLY (FCPS).

A. Field Charging Power Supply: The FCPS is a device designed for use as either a remote 24 volt power supply or used to power Notification Appliances.

1. The FCPS shall offer up to 8.0 amps of regulated 24 volt power. It shall include an integral charger designed to charge 7.0 amp hour batteries and to support 60 hour standby.
2. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a relay. Four outputs (two Style Y or Z and two style Y) shall be available for connection to the Notification devices.
3. The FCPS shall include an attractive surface mount back box.
4. The Field Charging Power Supply shall include the ability to delay the AC fail delay per NFPA requirements.
5. The FCPS include power limited circuitry, per 1995 UL standards.
6. Provide quantity as required to serve devices shown on plans. Locate in mechanical, electrical or storage rooms. Extend circuit from nearest emergency panelboard 120V, 20A, spare breaker. Intent is to distribute the loads to limit wire runs and voltage drop.

2.8 FIRE ALARM WIRE AND CABLE

A. Fire Alarm Power Branch Circuits: Specified in Section 260123.

B. Alarm System Wiring Within Building: Minimum size #16 AWG for initiating circuits and #14 AWG for alarm signal circuits, all copper-THWN, except as noted. Non power-limited wiring and exposed wiring shall be in rigid conduit or electrical metallic tubing or flexible metal conduit in accordance with Specifications for locations used, see Section 260123 - Wire and Cable: Wiring Methods. Concealed power limited wiring in dry locations above ceilings, in attic space, in stud walls, except as noted, shall be fire resistant teflon covered cables approved for use in an air plenum for fire alarm system.
   1. Cables shall be properly supported, labeled and tie wrapped.
   2. Complete installation shall meet requirements of NEC Article 760 "Fire Protective Signaling Systems."
   3. Cables shall be separated from any conductors of power or class 1 circuits and shall not enter in same conduits or J-boxes.

C. SLC Multiplex Communication Loop: Twisted shielded pair sized per manufacturer and installed in conduit.

D. All wiring shall be per manufacturers recommendations for load and length required.

2.9 ENCLOSURES

A. Control panels shall be housed in UL listed cabinets suitable for surface or semi-flush mounting. Cabinets shall be corrosion protected, given a rust-resistant prime coat, and the manufacturer’s standard finish. Mount flush in finished areas. All panel locks shall accept Gamewell, Simplex or FCI key.

2.10 FIREMAN’S KEY BOXES

A. Fireman’s Key Boxes: Knox or Supra - Recessed with tamper switch and high security lock to match Fire Department standards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install system in accordance with manufacturer's instructions.

B. Wiring shall be concealed in walls and above ceilings. Wiring in exposed construction shall be enclosed in conduit and run along structural members and painted to match.

C. Minimum size conduit: 3/4 inch. Refer to above paragraph: FIRE ALARM WIRE AND CABLE.

D. Install manual station with operating handle 48 inches above floor. Install audible and visual signal devices 80 inches above floor, or 6” below ceiling whichever is lower, except as noted.

E. Smoke detectors shall not be installed prior to system programming and testing period. If

construction is on going during this period, then protect the smoke detectors from contamination and physical damage.

F. Automatic Detector Installation: Per NFPA 72.

G. Provide nameplates identifying all equipment, junction boxes and controls. Paint all junction boxes red.

H. Wiring Color Code: See section 260195.

I. All devices and panels shall be flush mounted in finished areas and may be surface mounted in unfinished areas such as storage rooms. Where devices are surface mounted, the back box shall be a cast red box designed to mate with the device for a smooth appearance.

J. Wire installation shall be inspected by the fire department. Coordinate and ask for inspections from the fire department.

K. Key box shall be located recessed in the wall of the exterior of the building as indicated on the plans.

L. Factory Trained, licensed authorized technical representative of the manufacturer of the equipment shall adjust taps after installation to meet code requirements.

3.2 MANUFACTURER'S FIELD SERVICES

A. Provide the services of a Factory Trained, licensed authorized technical representative of the manufacturer of the equipment to supervise the installation and final connections, plus adjusting, programming and all testing of the system required to assure a complete and fully operative facility in accordance with the specifications; and to instruct designated personnel in the operation, adjustment, testing and maintenance of the system. Provide letter certifying results of test.

B. Include testing at substantial completion, at 6 months after occupancy and again two weeks prior to end of first year warranty. (Total of 3 complete documented tests). Invite the Owner, Architect and Local Fire Department to witness each test.

C. Include testing of the fire alarm system audio/visual devices to assure that the signals are operating according to the guidelines set by the NFPA 72 and the Americans with Disabilities Act (ADA).
   1. The limitations are as follows: NFPA – "Audible signals intended for operation in the public mode should have a sound level of not less than 75 dBA at 10 feet or more than 130 dBA at the minimum hearing distance from the audible appliance." ADA – "Audible emergency alarms shall produce a sound that exceeds the prevailing equivalent sound level in the room or space by at least 15 dBA or exceeds any maximum sound level with a duration of 60 seconds by 5 dBA, whichever is louder. Sound levels for alarm signals shall not exceed 120 dBA."
   2. Test the audio/visual units and make adjustments where required, including setting volume of horns and replacing strobes with proper intensity level. If horns are not adjustable then replace for proper dB level. Submit findings in writing, with areas marked that do not meet criteria after adjustments have been made.

3.3 FIELD TEST

A. Test in accordance with NFPA 72 and local fire department requirements. See Submittals item above.

B. Test shall include but not be limited to:
   1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
   2. Open initiating device circuits and verify that the trouble signal actuates.
   3. Open signaling line circuits and verify that the trouble signal actuates.
   4. Open and short notification appliance circuits and verify that trouble signal actuates.
   5. Open and short (wire only) network communications and verify that trouble signals are received at network annunciators or reporting terminals.
   6. Ground initiating device circuits and verify response of trouble signals.
   7. Ground signaling line circuits and verify response of trouble signals.
   8. Ground notification appliance circuits and verify response of trouble signals.
   9. Check alert tone to all alarm notification devices.
   10. Check installation, supervision, and operation of all intelligent smoke detectors using walk test.
   11. Each of the alarm conditions that the system is required to detect shall be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control panel points.
   12. When the Vendor determines that the system must be equipped with optional features to satisfy this specification, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.4 FINAL INSPECTION

A. A factory trained representative shall demonstrate that the system functions as specified.

B. Demonstrate in the presence of the Owner, Local Fire Chief, and the contractor. Invite the Architect's representative.

3.5 INSTRUCTIONS

A. In addition to the site training on programming features previously specified, provide minimum of two four hour periods to instruct the owner in the proper operation and maintenance requirements of the system. Provide one four hour period at substantial completion (after all testing and the system is fully operational and accepted by the fire department) and the other four hour period six months after substantial completion.

B. Provide a typewritten, bound, laminated "Sequence of Operation" to the Owner.

END OF SECTION 260721

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SECTION 260741 – TELEPHONE/DATA SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Interior Raceways and Junction Boxes.

B. Exterior Raceways.

1.2 RELATED SECTIONS

A. Section 061000: Rough Carpentry

B. Section 099000: Painting: Field Painting of Backboards and Cabinets.

C. Section 260010: Basic Electrical Requirements.

D. Section 260111: Conduit.

E. Section 260130: Boxes.

F. Section 260195: Electrical Identification.

G. Section 312000: Earth Moving.

1.3 QUALITY ASSURANCE

A. Install work in accordance with University of Southern Maine's standards, rules and regulations.

1.4 SUBMITTALS

A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Section 013300.

1.5 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations and mounting heights of outlets if not as shown on Drawings, plus pull and junction boxes larger than 12x12x6 inches, racks, backboard and panels.

B. Accurately record actual routing of conduits larger than 2 inches and cables containing 25 pairs or more. Indicate dimension from nearest column lines on As-Built Drawings.

1.6 PROJECT CONDITIONS

A. The Telephone System will be installed by the Owner.

B. The Data Networking System (cabling, racks, patch panels, switches, testing, etc…) will be installed by the Owner.

1.7 COORDINATION

A. Locate such that outlets are readily accessible.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Verify that field measurements are as shown on Drawings.

3.2 INSTALLATION

A. Install properly supported conduit(s) as detailed from each outlet location to above an accessible ceiling.

B. Install polyethylene pulling string in each empty conduit.

END OF SECTION 260741

SECTION 263213 - ENGINE GENERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Division 26 Section “Basic Electrical Requirements”.

1.2 SUMMARY

A. Section includes packaged engine-generator sets for standby power supply with the following features:
   1. Diesel engine.
   2. Unit-mounted cooling system.
   3. Unit-mounted and remote-mounted control and monitoring.
   4. Exhaust silencer and fittings.
   5. Fuel fittings.
   6. Remote control panel.
   7. Battery and charger.
   8. Performance requirements for sensitive loads.
   9. Weatherproof Acoustic enclosure.

B. Related Requirements:
   1. Section 263600 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.3 DEFINITIONS

A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

B. EPS: Emergency power supply.

C. EPSS: Emergency power supply system.

1.4 REFERENCES

A. ANSI/NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).

B. ANSI/NEMA MG1 – Motors and Generators.

C. NFPA 110 – Emergency and Standby Power Systems.

D. NEMA Standards.

E. NFPA 70 (NEC) latest edition.

F. U.L. standards

G. ANSI standards

1.5 SUBMITTALS

A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Section 013300 – Submittal Procedures.

B. Product Data: For each type of packaged engine generator indicated:
1. Include drawings showing plan and elevation views with overall and interconnection dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, and electrical diagrams including schematic and interconnection diagrams.
2. Include data showing dimensions, weights, ratings, interconnection points, and internal wiring diagrams for engine, generator, control panel, battery, battery rack, battery charger, exhaust silencer, and vibration isolators.
3. Include furnished specialties and accessories.
4. Thermal damage curve for generator.
5. Time-current characteristic curves for generator protective device.
6. Include documentation showing proof of U.L. and factory tests.
7. Submit Manufacturer's instructions.
8. Include sample of second year extended service contract listing services included and costs. The cost of this service contract is not included. The Owner reserves the right to accept this additional service once the one-year guarantee is successfully completed.
9. Include list of extra materials.

C. Shop Drawings:
1. Include plans and elevations for engine-generator set and other components specified. Indicate access requirements affected by height of sub-base fuel tank.
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. Identify fluid drain ports and clearance requirements for proper fluid drain.
4. Design calculations for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
5. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include base weights.
6. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams showing terminal markings for EPS equipment and functional relationship between all electrical components.

D. Manufacturer Seismic Qualification Certification: Submit certification that engine-generator set, batteries, battery racks, accessories, and components will withstand seismic forces refer to Section 260100. 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 unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. 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. Qualification Data: For manufacturer.

F. Source quality-control test reports.
1. Certified summary of prototype-unit test report.
2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
3. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
4. Report of sound generation.
5. Report of exhaust emissions showing compliance with applicable regulations.
6. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

G. Field quality-control test reports.

H. Warranty: Special warranty specified in this Section.

1.6 PROJECT RECORD DOCUMENTS

A. Accurately record location of engine generator and mechanical and electrical connections.

1.7 OPERATION AND MAINTENANCE DATA

A. For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Include instructions for normal operation, routine maintenance requirements, service manuals for engine, oil sampling and analysis for engine wear, and emergency maintenance procedures.
2. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
1. Maintenance Proximity: Not more than four hours' normal travel time from Installer's place of business to Project site.

B. Manufacturer Qualifications:

1. A qualified manufacturer. Maintain, within 200 miles (321 km) of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
2. Company specializing in manufacturing the products specified in the Section with minimum five years documented experience.
3. Company maintaining engineering and service departments capable of rendering advice regarding installation and final adjustment of the system.

C. Supplier/Installer Qualifications:
1. Authorized distributor of engine generator manufacturer with service facilities within 100 miles of project site and minimum three years documented experience.
2. Company offering service contracts for continuing factory authorized service after the initial warranty period.

D. Delivery, Storage and Handling
1. Accept packaged engine generator set and accessories on site in crates and verify damage.
2. Protect equipment from dirt and moisture by securely wrapping in heavy plastic.

E. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

F. 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.

G. Comply with ASME B15.1.

H. Comply with NFPA 37.

I. Comply with NFPA 70.

J. Comply with NFPA 110 requirements for Level 1 emergency power supply system.

K. Comply with UL 2200.

L. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

M. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

1.9 PROJECT CONDITIONS

A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
1. Ambient Temperature: Minus 15° to plus 40°C.
2. Relative Humidity: 0 to 95%.
3. Altitude: Sea level to 1000 feet (300 m).

1.10 COORDINATION

A. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.11 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

1.12 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

1.13 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
2. Filters: One set each of lubricating oil, fuel, and combustion-air filters.
3. Furnish one set of tools required for preventative maintenance of the engine generator system. Package tools in adequately sized metal tool box.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Caterpillar; Engine Div.
2. Kohler Co.; Generator Division.
3. Onan/Cummins Power Generation; Industrial Business Group.

B. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. ASME Compliance: Comply with ASME B15.1.

B. Engine Exhaust Emissions: Comply with EPA Tier 3 requirements and applicable state and local government requirements.

2.3 ENGINE-GENERATOR SET

A. Factory-assembled and -tested, engine-generator set.

B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.

C. Capacities and Characteristics:
1. Engine generator Set, factory designed, assembled and tested, mounted on steel structural skid base with sub-base fuel tank, starting batteries and all accessories for a complete package ready to provide source of emergency power.
   a. Designed as the source for an NFPA 110 EPSS, Class 2,Type 10, Level 1(2hr fuel supply, 10 second transfer, Life Safety).
2. Power Output Ratings: Minimum 125kW/156kVA Nominal rating; standby rating using engine-mounted radiator, all designed for 120/208 volts, 3Ø, 4 Wire, 60 Hz.
3. Skid base mounted radiator system including belt driven pusher fan, coolant pump and thermostat temperature control. Rated for full load operation in a 50°C ambient. Provide radiator with duct adapter flange and minimum 50% ethylene glycol antifreeze solution.
4. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

D. Generator-Set Performance:
1. Voltage Regulation under load from no load to 100% load: Plus or minus 1%.
2. Random Voltage Variation for constant loads, from no load to 100% load: not to exceed plus or minus 1% of mean value.
3. Frequency Regulation under varying loads from no load to 100% load: 5% with isochronous electronic governor.
4. Random Frequency Variation for constant loads, from no load to 100% load: not to exceed plus or minus 1% of mean value.
5. AC Waveform Total Harmonic Distortion (THD): Less than 5% no load to full linear load and less than 3% for any single harmonic.
6. Telephone Influence Factor (TIF): Less than 50 per NEMA MG1.
7. Alternator Temperature Rise at rated load: Less than 125 Deg C at standby rating per NEMA MG1, IEEE 115 and IEC34-1.
8. Maximum Sound Level at 23 Feet at full load: 87.5 dBA.
9. Remote start features with cycle cranking of 15 seconds ON, 15 seconds OFF, for three attempts (total 75 seconds). If engine fails to start, lock out engine and indicate over-crank on alarm panel.
10. Unit shall shut down and lock out and indicate cause on alarm panel upon initiation of herein specified Safety Devices.
11. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not

less than 10 seconds and then clear the fault automatically, without damage to generator system components.

12. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.4 ENGINE

A. Fuel: Fuel oil, Grade DF-2.

B. Rated Engine Speed: 1800 rpm.

C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm (11.4 m/s).

D. Lubrication System: The following items are mounted on engine or skid:
   1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
   2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
   3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

E. Jacket Coolant Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.

F. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.
   1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
   2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
   3. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
   4. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
      a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180°F (82°C), and non-collapsible under vacuum.
      b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.
   5. Fan: Driven by multiple belts from engine shaft.

G. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

   1. Minimum sound attenuation of 25 dB at 500 Hz.
   2. Sound level measured at a distance of 23 feet (8 m) from exhaust discharge after installation is complete shall be 74 dBA or less at full load.

H. Air-Intake Filter: Standard-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

I. Starting System: 12-V electric, with negative ground.
   1. Components: Sized so they are not damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Performance Requirements" Article.
   2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
   3. Cranking Cycle: As required by NFPA 110 for system level specified.
   4. Battery: Nicad, with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least three times without recharging.
   5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
   6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10°C regardless of external ambient temperature within range specified in "Performance Requirements" Article. Include accessories required to support and fasten batteries in place. Provide ventilation to exhaust battery gases.
   7. Battery Stand: Factory-fabricated, two-tier metal with acid-resistant finish designed to hold the quantity of battery cells required and to maintain the arrangement to minimize lengths of battery interconnections.
   8. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
   9. Battery Charger: Current-limiting, automatic-equalizing and float-charging type designed for Nicad batteries. Unit shall comply with UL 1236 and include the following features:
      a. Operation: Equalizing-charging rate of 10A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
      b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40°F (minus 40°C) to 140°F (plus 60 deg C) to prevent overcharging at high temperatures and undercharging at low temperatures.
      c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
      d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
      e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
      f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.5 DIESEL FUEL-OIL SYSTEM

A. Comply with NFPA 30.

B. Piping: Fuel-oil piping shall be Schedule 40 black steel, complying with requirements in Section 231113 "Facility Fuel-Oil Piping." Cast iron, aluminum, copper, and galvanizing shall not be used in the fuel-oil system.

C. Main Fuel Pump: Mounted on engine to provide primary fuel flow under starting and load conditions.

D. Fuel Filtering: Remove water and contaminants larger than 1 micron.

E. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

F. Subbase-Mounted, Double-Wall, Fuel-Oil Tank: Factory installed and piped, complying with UL 142 fuel-oil tank. Features include the following:
   1. Tank level indicator.
   2. Fuel-Tank Capacity: Minimum 133 percent of total fuel required for periodic maintenance operations between fuel refills, plus fuel for a minimum of 24 hours of continuous operation.
   3. Leak detection in interstitial space.
   4. Vandal-resistant fill cap.
   5. Containment Provisions: Comply with requirements of authorities having jurisdiction.

2.6 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms.

B. Provide minimum run time control set for 15 minutes with override only by operation of a remote emergency-stop switch.

C. Comply with UL 508A.

D. Configuration: Operating and safety indications, protective devices, basic system controls, engine gages, instrument transformers, generator disconnect switch or circuit breaker, and other indicated components shall be grouped in a combination control and power panel. Control and monitoring section of panel shall be isolated from power sections by steel barriers. Panel shall be powered from the engine-generator set battery. Panel features shall include the following:

E. Indicating Devices : As required by NFPA 110 for Level 1 system, including the following:
   1. AC voltmeter.
   2. AC ammeter.
   3. AC frequency meter.
   4. EPS supplying load indicator.
   5. Ammeter and voltmeter phase-selector switches.
   6. DC voltmeter (alternator battery charging).
   7. Engine-coolant temperature gage.

8. Engine lubricating-oil pressure gage.
9. Running-time meter.
10. Current and Potential Transformers: Instrument accuracy class.

F. Protective Devices and Controls in Local Control Panel: Shutdown devices and common visual alarm indication as required by NFPA 110 for Level 1 system, including the following:
1. Start-stop switch.
2. Overcrank shutdown device.
3. Overspeed shutdown device.
4. Coolant high-temperature shutdown device.
5. Coolant low-level shutdown device.
6. Low lube oil pressure shutdown device.
7. Air shutdown damper shutdown device when used.
8. Overcrank alarm.
9. Overspeed alarm.
10. Coolant high-temperature alarm.
11. Coolant low-temperature alarm.
12. Coolant low-level alarm.
13. Low lube oil pressure alarm.
14. Air shutdown damper alarm when used.
15. Lamp test.
16. Contacts for local and remote common alarm.
17. Coolant high-temperature prealarm.
18. Generator-voltage adjusting rheostat.
19. Main fuel tank low-level alarm.
    a. Low fuel level alarm shall be initiated when the level falls below that required for operation for the duration required in "Fuel Tank Capacity".
20. Run-Off-Auto switch.
21. Control switch not in automatic position alarm.
22. Low cranking voltage alarm.
23. Battery-charger malfunction alarm.
24. Battery low-voltage alarm.
25. Battery high-voltage alarm.
26. Generator overcurrent protective device not closed alarm.

G. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

H. Remote Alarm Annunciator: An LED labeled with proper alarm conditions shall identify each alarm event, and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.
1. Overcrank alarm.
2. Coolant low-temperature alarm.
3. High engine temperature prealarm.
4. High engine temperature alarm.
5. Low lube oil pressure alarm.
6. Overspeed alarm.

7. Low fuel main tank alarm.
8. Low coolant level alarm.
9. Low cranking voltage alarm.
10. Contacts for local and remote common alarm.
11. Audible-alarm silencing switch.
12. Air shutdown damper when used.
13. Run-Off-Auto switch.
14. Control switch not in automatic position alarm.
15. Fuel tank derangement alarm.
16. Fuel tank high-level shutdown of fuel supply alarm.
17. Lamp test.
18. Low cranking voltage alarm.
19. Generator overcurrent protective device not closed.

I. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

J. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation. Provide only as required by Local Authority Having Jurisdiction.

2.7 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Circuit Breaker: Molded-case, electronic-trip type; 100 percent rated; complying with UL 489. Sized as shown on Power Riser Diagram.
1. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
2. Trip Settings: Selected to coordinate with generator thermal damage curve.
3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
4. Mounting: Integrated with control and monitoring panel.

2.8 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required. Provide 12 lead alternator.

E. Range: Provide broad range of output voltage by adjusting the excitation level.

F. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

G. Enclosure: Dripproof.

H. Instrument Transformers: Mounted within generator enclosure.

I. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified and as required by NFPA 110.
   1. Adjusting Rheostat on Control and Monitoring Panel: Provide plus or minus 5 percent adjustment of output-voltage operating band.
   2. Maintain voltage within 15 percent on one step, full load.
   3. Provide anti-hunt provision to stabilize voltage.
   4. Maintain frequency within 5 percent and stabilize at rated frequency within 2 seconds.

J. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

K. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

L. Subtransient Reactance: 12 percent, maximum.

2.9 OUTDOOR SOUND ATTENUATING GENERATOR-SET ENCLOSURE

A. Description: Vandal-resistant, Level 2 sound-attenuating, weatherproof steel housing, wind resistant up to 100 mph (160 km/h). Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.

B. Description: Prefabricated or pre-engineered enclosure with the following features:
   1. Minimum 14-gauge steel construction (panels) with Stainless steel hardware.
   2. Corrosion resistant zinc phosphate pretreatment, e-coat primer and super-durable powder topcoat paint.
   3. Louvers: Equipped with bird screen and filter arranged to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents.
   4. Hinged Doors: With padlocking provisions.
   5. Ventilation: Fixed or motorized louvers equipped with bird screen and filter arranged to permit air circulation while excluding exterior dust, birds, and rodents. With rain hoods for all inlets.
   6. Muffler Location: Within enclosure.
   7. All factory installed features shall be pre-wired.
   8. Fuel and electrical stub-up area within enclosure perimeter.
   9. Seismic isolators.
   10. Average Sound Pressure Level at 7 meters measured per ANSI S1.13 and ANSI S12.18: 100% load - 74 dB(A), 50% load - 72 dB(A).
   11. Approximate dimensions: 159"L x 41"W x 98"H.

C. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.
   1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.

2. Automatic Dampers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating.

2.10 VIBRATION ISOLATION DEVICES

A. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.
   1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
   2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
   3. Minimum Additional Travel: 50 percent of required deflection at rated load.
   4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
   5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.11 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.12 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
   1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.

B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
   1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
   2. Test generator, exciter, and voltage regulator as a unit.
   3. Full load run.
   4. Maximum power.
   5. Voltage regulation.
   6. Transient and steady-state governing.
   7. Single-step load pickup.
   8. Safety shutdown.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work and field dimensions are as shown on Drawings. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

B. Verify that required utilities are available in proper location and ready for use. Examine roughing-in for electrical connections. Verify actual locations of connections before packaged engine-generator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Beginning installation means installer accepts existing conditions.

3.2 INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.

B. Equipment Mounting:

1. Install packaged engine generators on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
2. Coordinate size and location of concrete bases for packaged engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

C. Install packaged engine-generator to provide access, without removing connections or accessories, for periodic maintenance.

D. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.3 CONNECTIONS

A. Ground equipment according to Division 26 "Grounding and Bonding".

B. Connect wiring according to Division 26 “Wire and Cable”. Provide a minimum of one 90 degree bend in flexible conduit routed to the generator set from a stationary element.

C. Balance single-phase loads to obtain a maximum of 10 percent unbalance between any two phases.

3.4 IDENTIFICATION

A. Identify system components according to Division 26 "Identification for Electrical Systems".

B. Install a sign indicating the generator neutral is bonded to the main service neutral at the main service location.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections.

C. Tests and Inspections:
   1. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in the first two subparagraphs as specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
      a. Visual and Mechanical Inspection
         1) Compare equipment nameplate data with drawings and specifications.
         2) Inspect physical and mechanical condition.
         3) Inspect anchorage, alignment, and grounding.
         4) Verify the unit is clean.
      b. Electrical and Mechanical Tests
         1) Verify phase rotation, phasing, and synchronized operation as required by the application.
         2) Functionally test engine shutdown for low oil pressure, over temperature, overspeed, and other protection features as applicable.
         3) Conduct performance test in accordance with NFPA 110.
         4) Verify correct functioning of the governor and regulator.
   2. Load Test
      a. Provide full load test at the site, after installation. Utilize portable resistance load bank, to augment transferred loads to meet full load requirements. Simulate power failure including operation of transfer switch, automatic starting cycle, and automatic shutdown, and return to normal.
         1) Run set at 50% load for 2 hours.
         2) Run set at 75% load for 2 hours.
         3) Run set at 100% load for 1 hour.
         4) Run test continuously from no load to full load. If tests is interrupted for more than one hour then restart from step 1.
      b. During test, record the following at 30 minute intervals:
         1) Time of day.
         2) Engine Coolant temperature.
         3) Outside air temperature.
         4) Room temperature.
         5) Kilowatts.
         6) Amperes.

7) Voltage.
8) Frequency.
9) Oil pressure.

3. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
4. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
   a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
   b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
   c. Verify acceptance of charge for each element of the battery after discharge.
   d. Verify that measurements are within manufacturer's specifications.
5. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
6. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
7. Exhaust Emissions Test: Comply with applicable government test criteria.
8. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
9. Harmonic-Content Tests: Measure harmonic content of output voltage at 25 percent and 100 percent of rated linear load. Verify that harmonic content is within specified limits.
10. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at four locations on the property line, and compare measured levels with required values.

D. Coordinate tests with tests for transfer switches and run them concurrently.

E. Test instruments shall have been calibrated within the last 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.

F. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.

G. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.

H. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

I. Remove and replace malfunctioning units and retest as specified above.

J. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

K. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators. Refer to Division 01 Section "Demonstration and Training".
   1. Describe loads connected to standby system and restrictions for future load additions.
   2. Simulate power outage by interrupting normal source, and demonstrate that system operates to provide emergency power.

END OF SECTION 263213

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SECTION 263600 - TRANSFER SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Section 260100 – Basic Electrical Requirements

1.2 SUMMARY

A. This Section includes transfer switches rated 600V and less, including the following:

1. Automatic transfer switches.

1.3 SUBMITTALS

A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Section 013300 – Submittal Procedures.

B. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

C. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

D. Manufacturer Seismic Qualification Certification: Submit certification that transfer switches accessories, and components will withstand seismic forces, refer to Section 260500. 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 unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. 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. Qualification Data: For manufacturer.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Features and operating sequences, both automatic and manual.
2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.

1. Testing Agency Qualifications: Transfer switches shall be tested in conjunction with the Emergency Generator.

B. Source Limitations: Obtain automatic transfer switches and remote annunciator through one source from a single manufacturer.

C. Electrical Components, Devices, and Accessories:
1. Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Listed by Underwriters' Laboratory under Std. UL 1008 for emergency systems and all classes of load and CSA approved.
3. Units shall be enclosed in a wall mounted NEMA 1 enclosure and sized as indicated on the drawings.

D. Comply with NEMA ICS 1.

E. Comply with NFPA 70.

F. Comply with NFPA 110.

G. Comply with UL 1008 unless requirements of these Specifications are stricter.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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. Contactor Transfer Switches:
   a. Emerson Network Power; ASCO.
   b. Caterpillar; Engine Div.

c. Kohler Power Systems; Generator Division.
d. Onan/Cummins Power Generation; Industrial Business Group.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20°C to plus 70°C.

D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E. Electrical Operation: Accomplish by a non-fused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
2. Switch Action: Double throw; mechanically held in both directions.
3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225A and higher, shall have separate arcing contacts.

G. Neutral Terminal: Solid and fully rated, unless otherwise indicated.

H. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Division 26 Section "Identification for Electrical Systems."

1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

I. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 AUTOMATIC TRANSFER SWITCHES

A. Switch Ratings: 120/208 volts, 3Ø, 4 Wire, 60 Hz, Ampere rating as indicated on drawings.

B. Transfer switches shall be as manufactured by same manufacturer of generator set.

C. Comply with Level 1 equipment according to NFPA 110.

D. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

E. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

F. Automatic Transfer-Switch Features: Three phase automatic transfer switches shall remotely start generator set automatically upon interruption of normal power and transfer the load circuits when the set reaches proper speed and voltage. When normal power is restored, the automatic switch shall time out for a cool down period of 0-30 minutes (adjustable) before it automatically stops generator set. The transfer switches shall include the following features:
   1. Under-voltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
   2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
   3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
   4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained under-voltage of emergency source, provided normal supply has been restored.
   5. Test Transfer Switch: Simulates power outage. When switched to "off" position standby starts and assumes load, when returned to normal "on" position, the load transfers back to the line and the set stops. Include terminal block for remote test switch.
   6. Switch-Position Pilot Lights: Indicate source to which load is connected.
   7. Cranking Limiter: De-energize start circuit if engine fails to start as herein specified.
   8. Meters: Normal and emergency lights, exerciser set clock, running time meter AC voltmeter, AC ammeter.
   9. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
      a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
      b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
   10. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10A at 240V AC.

11. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
12. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10A at 32V DC minimum.
13. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
14. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
    a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
    b. Push-button programming control with digital display of settings.
    c. Integral battery operation of time switch when normal control power is not available.
15. Auxiliary contacts to notify the Building Energy Management system of AC power failure.

G. Automatic Sequence of Operation
1. Initiate Time Delay to Start Alternate Source Engine Generator: Upon initiation by normal source monitor.
2. Time Delay to Start Alternate Source Engine Generator: 0.1 to 10 seconds, adjustable. Set to allow start and transfer of emergency loads within 10 seconds per NFPA.
3. Initiate Transfer Load to Alternate Source: Upon initiation by normal source monitor and permission by alternate source monitor.
4. Time Delay Before Transfer to Alternate Power Source: 0.30 to 30 seconds, adjustable.
5. Once transferred to alternate source, initiate timer to transfer electrically operated switch.
6. Initiate Retransfer Load to Normal Source: Upon permission by normal source monitor.
7. Time Delay Before Transfer to Normal Power: 0.30 to 30 minutes adjustable; bypass time delay in event of alternate source failure. Set initially to 15 minutes.
8. Time Delay Before Engine Shut Down: 1.0 to 30 minutes, adjustable, of unloaded operation. Set initially to 30 minutes.
9. Alternate System Exerciser: Transfer load to alternate source during engine exercise period.
10. Additional features:
    a. Notify the Building Energy Management system of AC power failure.

2.4 SOURCE QUALITY CONTROL

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details.

B. Identify components according to Division 26 Section "Identification for Electrical Systems”.

C. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installation, including connections, and to assist in testing.
2. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

    a. Check for electrical continuity of circuits and for short circuits.
    b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
    c. Verify that manual transfer warnings are properly placed.
    d. Perform manual transfer operation.

5. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.

a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
b. Simulate loss of phase-to-ground voltage for each phase of normal source.
c. Verify time-delay settings.
d. Verify pickup and dropout voltages by data readout or inspection of control settings.
e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

C. Coordinate tests with tests of generator and run them concurrently.

D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

E. Remove and replace malfunctioning units and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below. Refer to Division 01 Section "Execution Requirements".

B. Coordinate this training with that for generator equipment.

END OF SECTION 263600

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SECTION 27 00 00
COMMUNICATIONS
(This Section included for Reference Only)

PART 1 GENERAL

1.01 DESCRIPTION

A. All cabling for voice and data will be CAT6. The general building contractor shall provide Inside Plant (ISP) pathways, which may include accessible utility corridors, finished and exposed metal cable tray or ladder, enclosed conduit, duct, or raceway including pull ropes to allow the installation of cable. Junction boxes shall be provided to allow installation of termination jacks at each station. The general contractor shall provide dedicated building closets, equipment backboards, wire management supports, termination racks, a grounding system, and an Outside Plant (OSP) conduit with pull ropes from the Building Distribution Frame (BDF) to nearest manhole.

B. US:IT will refer to the cable, which carries Telecommunications System signals, either integrated voice/data or voice only signals, as "voice" cable, i.e. voice riser, voice station cable.

C. ISP/OSP bid submittals shall include all costs for construction material, labor and any other items required for ISP/OSP installation.

D. The Contractor will be responsible for implementing all ISP/OSP per the design layout and specifications in its proposal. The design of all pathways and hardware shall allow for a 50% growth in capacity. This responsibility includes installation and termination of all ISP/OSP cabling to their proper equipment.

E. Particular consideration is to be given to the restoration of penetrated fire and smoke stop partitions and floor slabs to their original condition or to current fire code standards, whichever is greater.

F. The Contractor shall furnish blueprints, schedules and other technical data in order to illustrate to US:IT the intended method of installation. These shall define material type, path and concealment methods, distribution cable quantities, and room or wall space requirements. This information will be submitted prior to starting any portion of work and is subject to the approval of ***US:IT department***.

1.02 DEFINITIONS

A. Inside Plant (ISP) is defined as intra-building distribution of cable media such as riser cable both fiber and copper coax, station cable, station jack hardware, Intra building Distribution Frame (IDF) terminals, sleeves, conduit, raceways, distribution frame hardware, etc. All other physical plant such as grounding, power, conduit, and raceway not considered OSP are part of the ISP.

B. Outside Plant (OSP) are all facilities used to support inter-building connections, including (but not limited to) copper, fiber and coaxial cable, splices, terminators, pairs protection, grounding systems, ducts, conduits, manholes, and all related outside infrastructure. Also included are Main Distribution Frames (MDF) and Building Distribution Frames (BDF).

C. Voice Cable – Cabling, which carries Telecommunications System signals, either integrated voice/data or voice only signals, i.e. voice riser, voice station cable.

D. Data Cable – Cabling, which carries data communications signals, i.e. data riser, data station cable, data fiber.

E. Video Cable – Cabling, which carries video or TV communications signals, i.e. video riser, video station cable, video coax.

F. Approved contractor – The bidder shall be Cat 6 certified. Also, must have a minimum of 5 years telecommunications/data installation experience. Cabling technicians must be certified installers. No more than one helper per certified installer. Certification of technicians must be shown if requested.

1.03 REFERENCES

A. All work shall meet all applicable codes and standards.
   1. National Fire Protective Assoc. (NFPA) 70.
   2. Building Industry Consulting Service International (BICSI) Standards.
   3. National Electrical Manufacturers Assoc. (NEMA) Standards.
   4. Electronics Industry Assoc./Telecom. Industry Assoc. (EIA/TIA).
   5. US:IT requirements.

PART 2 PRODUCTS

2.01 OSP – DUCT SYSTEM

A. The Contractor shall be prudent in the design and installation and use of all available industry techniques to fully utilize individual ducts or raceways and avoid using existing spare ducts or raceways where feasible.

B. Each duct bank shall consist of three 4" conduits to each building. The duct bank sizing reflects the installation of video coax, data fiber, and voice cable. Contractors shall install Type C (Carlon 68515WH) and industry approved fittings. One 1¼" three cell maxicell shall be installed in one 4" conduit.

C. Where sharp bends or turns are required, prefabricated fittings will be used unless such bends or turns prohibit the pulling of large cables. In such cases, manholes or hand holes shall be installed.

D. Rigid conduit will be used where ducts run under roadways. Where conduits are installed in concrete slabs or where the minimum required depth is not feasible. All 4" Rigid conduits will extend a minimum of 10' past the outside wall and attach to ducts feeding the building.

E. The duct systems shall be sloped to permit penetrating water to drain towards the manhole(s). The highest point of the duct array will be at the building entry point. All duct systems will be marked with the appropriate marking tape on top. There must be a minimum of 4 inches of sand above the conduits before backfilling.

F. All unused ducts shall be provided with removable conduit plugs or equivalent for waterproofing and protection. All ducts shall be cleaned of earth and debris, and equipped with minimum 200-pound strength pull rope.

G. All cables entering ducts shall be sealed according to industry standards and provide a watertight seal.

2.02 MANHOLES AND HAND HOLES

A. New manholes shall be reinforced concrete construction, cast-in-place or pre-cast, and must meet industry standards for telephone manholes.

B. The manholes/hand holes sizes shall be a minimum of 4' x 4' x 4', up to a maximum of 6' x 12' x 7' (see manhole/conduit drawings for manholes sizes and locations).

C. A PVC water barrier shall be installed at each construction joint.

D. Maximum distances between manholes and from manhole to buildings shall not be great than 600 feet for a run containing an aggregate of a 45-degree bend and 400 feet for runs having an aggregate of a 90-degree bend.

E. On straight sections maximum distance between manholes shall be no greater than 600 feet.

F. Manhole lids will be permanently marked with the word "Telecom" or "Communications."

G. Each manhole must have an integral 7/8" inch steel ring 6" diameter as part of the manhole structure. A 12-inch circular sump hole must also be included at the lowest point in a manhole.

H. All manhole covers must meet industry standards for vehicular traffic loads.

2.03 TRENCHING, BACK-FILLING AND RESTORATION OF GROUNDS

A. Trenching shall be done using trenching machines or backhoes and supplemented by hand excavation where required in order to avoid utility disruption.

B. Ducts shall be placed on top of four inches (4") of sand bedding at the bottom of each duct run. An additional four inches (4") of sand shall be placed around and between ducts. A final four inches (4") of sand shall be placed on top such that an aggregate of twelve inches (12") exists from the floor of the duct trench and the top of the last four inches (4") of sand.

C. Below finished grade, just on top of the final layer of sand, and offset from the center of the duct bank, the Contractor shall place one (1) continuous plastic marking strip labeled "Communications."

D. Gravel backfill shall be used in paved areas and earth shall be used in lawn area. Backfill shall be free of large stones of 3" in diameter or greater.

E. All backfill materials shall be compacted 95%.

F. The Contractor shall repair all the University grounds and property to their pre-construction condition using materials of same or better quality. This includes, but is not limited to, re-paving, re-seeding, walls, fences, landscaping, utilities, signs, painting, curbing, etc.

G. Bituminous materials should be used where necessary for repairing roads, parking areas, and footpaths. The materials shall be provided in two (2) courses: two 2" binders and a 1" surface course. All existing paths and roadways of greater depth shall be repaired to match existing materials and depths.

H. US:IT reserves the right to inspect all materials to be used in the process required in this section on trenching, backfilling, restoration of grounds, and to demand changes in type and quality in order to meet US:IT standards. Such changes will be at the Contractor's expense unless US:IT requires materials of a higher quality than originally required by this document. In all cases concerning determination of "original condition", US:IT will be the judge and have final approval.

I. Trench depth, from the bottom of the trench to the top of finished grade will be three feet, eight inches (3' 8") under pavement, and two feet, two inches (2' 2") under finish grade.

2.04 CABLE IDENTIFICATION AND LABELING

A. After final acceptance, Contractor will prepare and submit cable OSP drawings. These site drawings will be supplied on reproducible materials, and the Contractor will add its distribution system and show at a minimum:
   1. Exact route of total outside plant including trenching routes.
   2. Depth of cable trench.
   3. Locator coordinates measurements from cable location to nearest building.
   4. Cable number, cable pair count, wire gauge, cable lengths, and cable types of every OSP copper, coax and fiber cable included in the system.

2.05 OSP CABLE SIZING

A. Contractor will design an OSP that is complete.
   1. **All** OSP pairs must be terminated in Northern 191 or CIRCA #2200B-100 fuse protectors.
   2. **All** fiber cable shall be Hitachi 12 multi-mode 62.5/125 and 12 single-mode fibers or as specified.
   3. **All** cable shall be rated for outside usage in duct systems.

2.06 CABLE TYPE, SPLICES AND PROTECTION

A. All Copper cable used in OSP shall be waterproof with moisture and heat resistant properties up to 125 degrees, Gel-Filled Core Duct/Direct Burial type, with a Metal Clad composition. All wire shall be Twisted Pair type PE89 jelly filled 24 AWG solid copper cables.

B. All splice connections in manholes shall be placed in re-enterable waterproof closures and sealed according to manufacturer's specifications. All splices shall be made with 3M modular connectors (4000-D) and enclosed in "Preform" enclosures.

C. All OSP will be properly grounded according to NEC Codes and BICSI Standards, and Local Codes and industry standards. All ground connections are subject to the inspection and approval of the US:IT, as well as State and Federal Inspectors.

D. All OSP will be enclosed in conduit or raceway where appropriate, such as required by Fire Codes, exposed to steam pressure relief valves, or in public areas.

2.07 ADMINISTRATIVE AND ACADEMIC BUILDING OSP DATA FIBER SIZING

A. Fiber cables shall be pulled to the BDF.

B. All fiber cables shall be properly terminated at the BDF.

C. In the fiber installation there will be no splices in the fiber cable, other than those at termination points.

D. All fiber cable shall be Hitachi 12 multi-mode 62.5/125 and 12 single-mode fibers or as specified.

2.08 OSP – VIDEO CABLE SPECIFICATIONS

A. All video cables for OSP will be Hitachi single-mode fiber.

B. Video fibers shall terminate on SC/APC fiber optic connectors.

2.09 CONFIGURATION AND SPECIFICATIONS FOR ISP

A. Where existing sleeves, riser conduit, etc., are insufficient for new riser cable, construction of new sleeves, cores, and conduit or raceway shall be proposed and included in the contractor's purchase price. A minimum of twelve inches is required between all phone/data services and any electrical circuits. This is a US:IT requirement.

B. There must be a 50% growth factor built in on all conduit runs used for Voice, Data and Video jacks. Minimum conduit for station runs will be 1" trade size conduit with proper fittings. A 1" NMT non-metallic tubing properly installed meeting all NMT requirements of NEC/BISCI and the University of Maine is also acceptable. There will be NO DAISY CHAINING of jacks for any reason. A pull string needs to be installed in all conduits used for ISP/OSP cabling.

C. Open Ceiling – All conduits will be installed above the tray or back to the proper IDF/BDF.

D. Suspended Ceiling – All conduits will be stubbed above the ceiling or back to proper IDF/BDF. Install B-Line cable tray in all corridors providing a continuous pathway back to the proper BDF/IDF.

E. All old cables are to be removed as required by the NEC.

2.10 CABLE ROUTING

A. It is mandatory that the contractor makes use of and provides cable pathway materials between all building MDFs, BDFs or IDFs. A 50% growth factor must be provided when a job is completed. A minimum of 12 inches shall be kept between all data and electrical pathways when being designed (US:IT requirements).

B. Such pathway materials may include:
1. Finished and exposed metal cable tray, ladder, or raceway.
2. Enclosed conduit or wireway through walls or ceiling plenums.
3. Sleeves and conduit.
4. Other materials as the contractor may require.

C. Provide B-Line – Part # FT2X12X10. Must be mounted no more than 12" above suspended ceiling, or 8' 6" in open corridors. A usable pull string is to be left in each cable tray on completion of cable installation.

D. It should be noted that US:IT will not supply pathway materials.

E. All raceways used for Telecom/Data shall be **Panduit**. They shall be sized properly for use. ONLY proper fittings for raceway shall be used.

2.11 CAT 6 REQUIREMENTS AND PARTS

A. All data cables shall be CAT6 Hitachi part # 30212-8.

B. All data cables installed shall be Hitachi part # 30212-8BL CAT6 with a PVC jacket being **blue**.

C. All dorm jacks shall be installed at 33" to bottom.

D. All E&G building jacks shall be installed 16" to the bottom.

E. All CAT6 cable shall be installed according to the NEC code, BICSI standards and EIA/TIA standards.

F. All CAT6 cable shall be installed on **blue** Hitachi part # 30212BL and terminated on Panduit jacks, part # CJ688PBB.

G. All CAT6 cable shall be 23 AWG and 8 conductors terminated as 568-A standards allow.

H. All raceway installed to be used for CAT6 installation must meet all BICSI standards as well as ANSI/TIA/EIA standards.

I. Cables shall terminate in proper Siemon part # HD6-24B-SIE patch panels rated for CAT6 specs, RJ45 faceplates with 110 terminations on back.

J. Patch cables rated for CAT6 100mb are to be supplied and installed.

K. CAT6 certification must be received prior to final payment.

L. Velcro required to tie and support cables.

M. All raceways for IT shall be properly sized for **Panduit** or 1" conduit.

2.12 DISTRIBUTION FRAME REQUIREMENTS

A. New IDF and BDF room construction shall be included in Building Design blueprints.

B. There shall be included, in the building, an equipment room as designated by US:IT strictly for data telecommunications. All BDF and IDF rooms shall be a minimum of 8' x 10' x 8', with signage indicating that the room is a data telecommunications facility.

C. An IDF room will be required per floor in order to keep distance requirements for CAT6 wiring within specifications. This room(s) shall be keyed to the telecommunications master key. A 50 pair feeder cable for voice shall be run to the BDF room from each IDF room. These cables should run in pipe chases of 4" conduits. A 12/12 fiber riser cable will be run from BDF to each IDF for data feed. BICSI and NEC standards and US:IT requirements must be met. RJ11 coax shall be installed to each IDF from the BDF. Air temperature and air movement should meet office requirements for the building.

D. BDF/IDF rooms should have a switched light with 50 ft. candles available and at least two isolated duplex outlets rated for 20 amps. A covered # 6 copper ground wire and bus bar must be installed at each IDF from main grounding frame in BDF and from racks installed at each IDF/BDF.

E. A # 4 copper ground wire, properly installed and terminated, will be required in all BDF rooms, part # SB477K.

F. Two 4" conduits from BDFs to IDFs with pull strings installed.

G. Three 4" conduits feeding BDF from OSP manholes.

H. All conduit, raceway, coring, and equipment backboards must be supplied and installed by the Contractor.

I. Contractor will be required, prior to start of project, to submit a floor-by-floor list of where new BDFs and IDFs will be required.

J. No sprinkler heads should be installed within the BDF/IDF rooms. Heat/smoke detectors should be installed where necessary for fire code compliance.

K. All cable will be marked clearly and legibly at both ends.

L. All cables and fiber shall be terminated on a 7' x 30' x 19' rack. All installed equipment shall meet all BISCI requirements as well as US:IT requirements. All racks shall be properly bonded to ground bar in IDF/BDF rooms.

M. One wall having a 4' x 8' x 3/4" sheet of plywood attached painted with fire retardant paint is required in the BDFs and IDFs. Plywood should be vertically mounted behind the racks installed 2' off the finished floor.

N. Wire management hardware located on three (3) walls above the racks is required in preparation of installation of termination equipment by the contractor (see diagram included in this document BDF/IDF requirements closet).

O. Single-mode fiber will be fusion spliced to factory ceramic SC and SC/APC pigtails.

P. Multi-mode fiber will be terminated using ST Unicams factory polished ceramic.

Q. All fiber patch panels are to be Seicore, sized to accept fibers from the OSP plant as well as riser for the IDFs.

1. Data telecommunication rooms (including but not limited to BDF and IDF closets): The BDF closets shall be on the lowest floor level of the building being served. An IDF closet is **required** for each floor above the lowest floor.
2. All BDF/IDF closets shall be designed as shown in the diagram below. Materials for this requirement are shown in the diagram.
3. All data telecommunication rooms must have a 3' door swinging out into the hallway.
4. All data telecommunication rooms are for **INFORMATION TECHNOLOGIES USE ONLY**; any other equipment needing IT service should be located in a separate mechanical room.

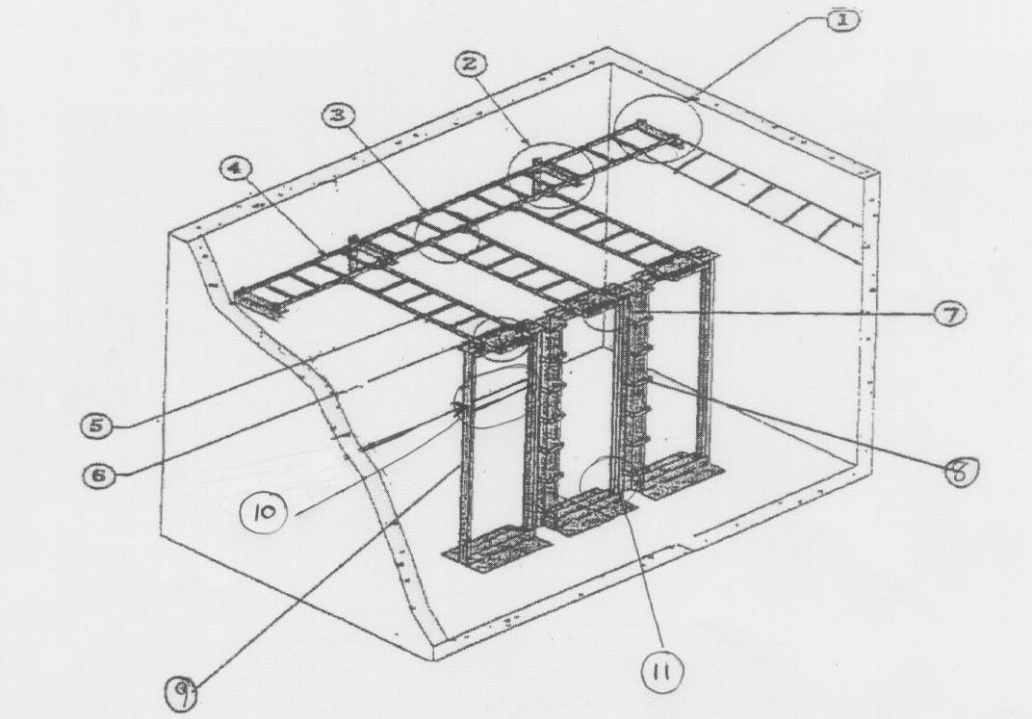
2.13 CABLE SUPPORT AND RACK PRODUCTS

A. All material to be installed to product specifications.

B. All material to match cable trays installed in the building.

C. All racking and cable tray to be grounded with # 6 green PVC ground wire.

BDF/IDF REQUIREMENTS (EXAMPLE USING B-LINE AND (SB) HARDWARE)



Item Number	Description of Item	Item Part Number
1	End Bracket Relay Wall Bracket	SB87019S2FB
2	Runway Wall Bracket	FTB12CS
3	90 deg. Splice Bar	90DEGREE KIT
4	Fast Splice Bar	FTSTLC
5	Cable Runway B-Line	FT2X12X10
6	Splice Washer Kit	WASHERSPL KIT
7	Runway Termination Kit	SB-2105-12-TG
8	Copper B-Line Vertical Management	SB57166D084AL
9	Copper B-Line Aluminum Rack	SB556084XUAL
10	Horizontal Management	CMPHH2
11	20 AMP Dedicated Electrical Outlet	

NOTE: Wire management required around each frame: top, bottom and side. This will be sized to fit each building requiring size changes to match density and count of building. All products and fittings are B-Line Cable Tray and fittings.

2.14 CABLE NETWORKS IDENTIFICATION AND LABELING

A. Each contractor shall permanently mark all cables with permanent labels.

B. Labels shall be waterproof materials with indelible text information and mechanical attachment or waterproof adhesive.

C. Each required label location shall contain all fields of required information below.

D. Required identification information shall include the following items, combined to produce a unique and non-duplicating identification for each cable. No two jacks within the cable plant shall have the same number.

E. Jacks shall show termination location; floor location and BDF/IDF location (i.e. basement – BDF A001; 1st floor to IDF B101; 2nd floor to IDF C201).

F. Where multiple cables have the same termination location and floor identification number, the contractor shall add an alpha/numeric suffix to provide non-duplicating identifiers (i.e. A201, A201B).

G. All jack locations should run straight back to the equipment rooms or cable trays in their own raceway.

H. Equipment rooms should have a switched light and at least two duplex outlets rated for 20 amps.

I. Pull strings are to be installed at the time of construction in all conduits.

J. If utilized, pull strings must be replaced prior to completion of project.

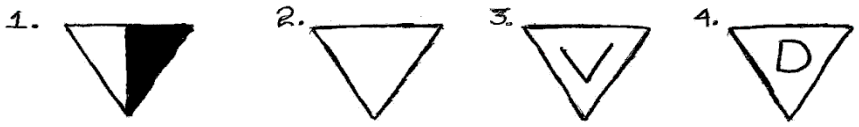
K. Cables need to be toned and correctly labeled at the time of installation.

L. Riser fiber cable shall be 12 strand multi-mode and 12 strand single-mode fiber.

M. Cables for voice and data shall not exceed 290’ end to end.

2.15 UNIFORM WIRING PLAN (UWP)

A. Below are the jacks and symbols to be used by the contractor when cables and terminations are installed. Panduit jacks and equipment will be used. All jacks will be wired as 568A and meet CAT6 certification.



B. UWP#1s – Consists of three separate cables (23 AWG), 2 blue data and 1 RG6 coax. (See symbol 1 above).

C. UWP#2s – Consists of two separate cables (23 AWG), 2 blue data, these are the standard for all offices. (See symbol 2 above).

D. UWP#3s – 1 blue voice cable only (23 AWG). This jack is used for alarm circuits mostly. (See symbol 3 above).

E. UWP#4s – 1 blue data cable (23 AWG). Used where no phone will ever be needed but data transmission is required. An example would be an in-house billing system, i.e. Harco. (See symbol 4 above).

2.16 VOICE AND DATA CABLE SPECIFICATIONS FOR HORIZONTAL CABLING

A. Cables will be 23 AWG 8 conductors Unshielded Twisted Pair (UTP).

B. All cables will be blue category 6 four pair and comply with EIA/TIA 568A standards.

2.17 VIDEO WIRING PLAN (UMP)

A. The contractor must install F59SSV quad shielded RG 6 type drop cables for subscriber loop locations. RG6 type subscriber drop cables are used to interconnect the TV outlet with multi-tap devices that will be installed at the BDFs or IDFs.

B. At the outlet, the contractor shall terminate the cable in the outlet connector using an F10F10S11-X straight jack. The TV outlet shall then be terminated using a 75-ohm F terminator.

2.18 VIDEO RISER CABLES

A. Where video riser cables are required between floor types F11SSEF and single-mode fiber will be installed.

B. Routing of video riser cables follows voice cable installation from floor to floor.

2.19 WIRELESS NETWORKING REQUIREMENTS

A. One (1) 1" conduit run to each location for networking cables.

B. Conduits will terminate either at BDF, IDF or above the cable trays with CAT6 data cable being installed.

C. All ANSI/TIA and NEC codes or requirements must be met.

2.20 CAMERA INSTALLATION

A. A 1" conduit from the camera location back to the cable tray or above suspended ceilings.

B. Conduits will terminate either at BDF, IDF or above the cable trays with blue CAT6 data cable being installed.

C. A blue CAT6 data cable shall be installed and terminated in an RJ45 Panduit jack.

D. Jack shall be labeled to show proper BDF or IDF location, i.e. Jack A1001 for BDF or B2001 for IDF.

E. Cameras to be used are axis 216FD for fixed dome inside installation.

F. Outside cameras are to be axis and will be listed by their needs. Recommended part # AXIS 223M, Outside Housing recommended part # AXIS #24889, including heater and blowers.

G. NUV for each building to be installed in BDF rooms equipment rack, part # 1PNUR1UST4TB8R must be able to record for 28 days.

2.21 OUTSIDE EMERGENCY PHONES

A. Two 1¼" conduits run to pedestal location, 1 for Telecom/fiber cables, and 1 for electrical circuit to be installed with ground fault interruption 20 Amp minimum 120v rated. Each to be terminated in the proper equipment rooms, i.e. electric to electric panel, IT to proper BDF room.

B. 1¼" conduits need to be rated for outdoor use, PVC schedule 40 recommended.

C. Symbol for location(s) is:

2.22 US:IT VOICE AND DATA CABLE SPECIFICATIONS FOR JACKS

A. All cables are 23 AWG 8 conductors unshielded twisted pair cable.

B. Category/Level 6 – cable must be 8 conductor and comply with EIA/TIA 568-A standards.

C. Color-coded with a blue PVC jacket.

D. DC Resistance 9.38 @ 100 meters.

E. DSC Resistance Unbalanced 5% maximum.

F. Impedance @ 250 MHZ 100 ± 15%.

G. Category/Level 6 – When requested for installation, specs will be given and approval from Telecommunications on the cable to be installed will be given.
   1. Characteristics:
      a. Propagation Delay @ 10 MHZ 5.7 per/meter.
      b. Delay Shew @ 25NS/100 meters.
      c. Attenuation crosstalk 11.4 db @ 250 MHZ.
   2. Specifications:
      a. Blue PVC jacket.
      b. 8 Conductors 23 gauge.
      c. DC Resistance 9.38/100 meters.
      d. DSC Resistance unbalanced 5% maximum.
      e. Pair to ground capacitance unbalanced maximum @ 1 KHZ 100m.
   3. Transmission Properties:
      a. Freq 427.0.
      b. Maximum attenuation @ 20 deg. Celsius 50.5.
      c. Near end crosstalk worst pair combination 64-15log (F/00.772).
      d. Power Sum N/A.
      e. Worst Pair SRL 10 db.
      f. Resistance OHMS 100 l15%.

2.23 INSTALL LEVEL 6 STANDARDS

A. ANSI/TIA.E1A 568A Category 6 E (400 MHZ):
   1. 155 mbps ATM and 100 mpbs Ethernet.
   2. 4 pair 23 gauge copper.
   3. ISO/IEC 11801.
   4. Min Bend Radius .820.
   5. PVC Blue Jacketed.
   6. Cable markings starting at 0 to 1000' per box.
   7. Non Plenum 75N4.

B. ETL Verified Electrical Performance:
   1. CAT6 STANDARDS:
      a. Input Impedance 100 ohm ± 15 ohm 1-100 MHZ.

b. Capacitance 4.6 NF/100 m nominal.
c. DE Resistance/Unbalanced 6.66 ohms/100 m max.
d. Propagation Delay 5.7 N/SEC/m mac at 10 MHZ.

2.24 TEST RECORDS FOR ISP/OSP

A. Contractor will test each OSP pair in each cable on an end-to-end basis after terminating. Maximum allowable defective pairs will be limited to 1% of the total number of pairs and a maximum of one (1) pair per 25-pair binder group. Defective pairs over 1% will require cable repair or replacement at the Contractor's expense.

B. ISP testing for each station cable is required with zero defective pairs acceptable.

C. The Contractor, at no cost to the University, will replace cables rejected by the US:IT department with new cable from end to end.

D. Records of testing will be delivered to US:IT in MSExcel format, or software that is compatible with MSExcel.

E. Building will not be accepted for service prior to records being received, thus no service will be provided.

PART 3 EXECUTION

3.01 OSP – FIBER INSTALLATION

A. No splices will be allowed in OSP fiber. Any faulty cables must be replaced at Contractor's expense.

B. All fiber cable must be installed in accordance with manufacturer recommended tensile specifications.

C. Lubricant must be used when installing fiber cable. This lubricant must be manufacturer guaranteed to be non-destructive to the cable sheath or any portion of the inner duct.

D. All fiber cables shall be terminated in an approved Lynn patch panel using approved ST, SC or SCAPC connectors. All connections shall be fusion splicing onto correct connectors. Labels shall show the destination of each fiber optic strand.

E. All fiber cable will be tested for loss and bandwidth according to the manufacturer's specifications. Tests shall be performed after all the cable has been installed, spliced and terminated.

F. All fiber cable shall be 62.5/125 multi-mode or hybrid Hitachi/Corning Fiber containing twelve multi-mode fibers and 12 single-mode fiber rated for outside usage in duct system.

3.02 OSP – DATA FIBER INSTALLATIONS

A. Specifications for Altos/Lst Cables:
1. Maximum attenuation: 3.5/1.0.
2. Minimum bandwidth: 120/500 850 MHZ to 1300 MHZ.
3. Gigabit Ethernet Distance Guarantee 500/1000.
4. Multi-mode/Single-mode.
5. Graded Index: 50 Gigabit Plus CL.
6. 62.5/125 micron core diameter (+/-3).
7. Maximum Tensile Loading: 600 lbf.

B. The Contractor is responsible for installation and testing of fiber. A loss of more than 2dB is not acceptable.

C. All fiber cable must be installed in accordance with manufacturer recommended tensile specifications.

D. All fiber cables shall be terminated in an approved patch panel using SC ceramic ferrule connectors. Single-mode fiber must also be properly terminated and marked using SC/APC or SC pigtails, both need to be fusion spliced. Labels shall show the destination of each data fiber optic strand.

E. All fiber must be tested prior to installation with an Optical Time Domain Reflectometer (OTDR) to insure cable integrity and to identify any damage due to shipping. An OTDR graph must be delivered to the University prior to the installation of the fiber cable and after the cable has been installed.

3.03 DATA FIBER TESTING

A. All fiber cable must be tested to guarantee the performance integrity of cables, bends, tensile loads and terminations or cross connects.

B. Each fiber cable must be tested for loss and bandwidth. Tests shall be performed upon completion of installation and termination.

C. Any cable that is found to be defective shall be repaired or replaced at the contractor's expense.

D. An OTDR graph must be provided for each fiber strand tested.

E. Testing must be accomplished with an OTDR.

3.04 INSIDE PLANT (ISP) INSTALLATION

A. The cable will be less than 280 feet from station jack to distribution frame termination.

B. All cable paths that will be used for Category 6 cable installation must meet all applicable codes, BICSI and ANSI/TIA/EIA standards.

C. When a cable must be created in an existing building, the following concealment methods are acceptable:
   1. Dry wall: fishing of hollow wall cavities.
   2. Plaster or Tile Wall: Color coordinated wire mold.
   3. Drop ceiling: Velcro every 10' and avoid lighting fixtures and all electrical conduit and raceway.
   4. Utility Corridors: Concealment not required; Velcro every 10' to (chases and trays) to self-supporting hangers, avoid receptacles and all electrical conduit/raceways. Clear and free conduit or riser sleeves are available for use wherever they are found and should be used first.
   5. Raceway shall be installed where indicated and when required to run on the surface of a wall. Raceway shall be Panduit and must be properly sized and meet the installation requirements of the manufacturer of the cable to be installed.

END OF SECTION 27 00 00

SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Preparing subgrades and finish grades. Cutting, filling, and providing additional materials required.
   2. Excavating, filling, and backfilling to grade.
   3. Excavating and backfilling for buried structures, tanks, pipes, wires, and conduits.
   4. Subbase and base course for drives and walks.
   5. Restoring loam and seeding lawns.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
   1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
   2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and finish pavement.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Crushed Stone(Drainage Fill): Crushed stone backfill to facilitate stormwater flow; that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
   1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
   2. Open(bulk) Excavation: Excavation more than 6 feet (3 m) in width.
   3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 2 cu. yd. (1.5 cu. m) for bulk excavation, footing, trench, and pit excavation, that cannot be removed by rock excavating equipment, without systematic drilling, ram hammering, or blasting, when permitted. Fragmented "weathered" rock which can be removed by excavation equipment with "ripper" teeth will be considered earth.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Subbase Course: Aggregate layer placed between the subgrade and base course beneath pavement.

K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each soil material proposed for fill and backfill as follows:
1. Classification according to ASTM D 2487; with particle gradation test results.
2. Laboratory compaction curve according to ASTM D 1557.

C. Pre-excavation Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.5 QUALITY ASSURANCE

A. Blasting: Not Anticipated. If ledge is encountered and blasting is approved by Owner, comply with applicable requirements in NFPA 495, "Explosive Materials Code," and prepare a blasting plan reporting the following:
1. Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
2. Seismographic monitoring during blasting operations.

B. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:
1. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
2. Seismographic monitoring during blasting operations.

C. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

1.6 PROJECT CONDITIONS

A. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
   1. Pre-mark the boundaries of your planned excavation with white paint, flags or stakes, so utility crews know where to mark their lines.
   2. Call Dig Safe, at either 811 or 1-888-DIGSAFE, at least 72 business hours - but no more than 30 calendar days - before starting work. Don't assume someone else will make the call.
   3. If blasting, notify Dig Safe at least 24 business hours in advance.
   4. Wait 72 business hours for lines to be located and marked with color-coded paint, flags or stakes. Note the color of the marks and the type of utilities they indicate. Transfer these marks to the As-Built drawings.
   5. Contact the landowner and other non-member utilities (water, sewer, gas, etc.), for them to mark the locations of their underground facilities. Transfer these marks to the As-Built drawings.
   6. Re-notify Dig Safe and the non-member utilities if the digging, drilling or blasting does not occur within 30 calendar days, or if the marks are lost due to weather conditions, site work activity or any other reason.
   7. Hand dig within 18 inches in any direction of any underground line until the line is exposed. Mechanical methods may be used for initial site penetration, such as removal of pavement or rock.
   8. Dig Safe requirements are in addition to town, city and/or state DOT street opening permit requirements.
   9. For complete Dig Safe requirements, visit their website.
   10. If you damage, dislocate or disturb any underground utility line, immediately notify the affected utility. If damage creates safety concerns, call the fire department and take immediate steps to safeguard health and property.
   11. Any time an underground line is damaged or disturbed, or if lines are improperly marked, you must call Dig Safe.

B. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect or Owner, and then only after arranging to provide temporary utility services according to requirements outlined in Section 311000.

D. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures are in place.

1.7 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction. The Contractor shall conduct his operations in conformity with all Federal and State permit requirements concerning water, air,

or noise pollution, or the disposal of contaminated or hazardous materials. Erosion control measures shown on the Plans are minimum only and are not intended to be complete. Satisfy the current requirements of the regulatory agencies.

B. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

1.8 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed, or abandoned in place.
   1. Arrange with utility companies to shut off indicated utilities.
   2. Owner will arrange to shut off indicated utilities within his control, when requested by Contractor.

B. Interrupting 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 and Owner not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's or Owner's written permission.

C. Excavate for and remove underground utilities indicated to be removed.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487 or a combination of these groups, free of rock or gravel larger than 6 inches (15 0 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 or a combination of these groups. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with 100 percent passing a 6-inch (150-mm) sieve, 25-70 percent passing a 1/4-inch (6-mm) sieve, 0-30 percent passing a No. 40 (0.425-mm) sieve, and not more than 7 percent passing a No. 200 (0.075-mm) sieve. Maximum size stone passes 6-inch sieve. MDOT spec. 703.06 Type D.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with 100 percent passing a 2-inch (50-mm) sieve, 45-70 percent passing a 1/2–inch (13-mm)sieve, 30-55 percent passing a 1/4–inch (6-mm)sieve, 0-20 percent passing a No. 40 (0.425-mm) sieve, and not more than 5 percent passing a No. 200 (0.075-mm) sieve. MDOT spec. 703.06 Type A.

F. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with 100 percent passing a 2-inch (50-mm) sieve, 25-100 percent passing 1/4-inch (6-mm) sieve, 0-30 percent passing the No. 40 (0.425-mm) sieve, and not more than 7 percent passing a No. 200 (0.075-mm) sieve.

G. Crushed Stone (Drainage Fill): Narrowly graded mixture of washed crushed stone; ASTM C 33; grading Size 56; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.

H. Granular Borrow: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with maximum stone size of 6”(150-mm); the portion passing a 3-inch (75-mm) sieve shall meet the following: 100 percent passing the 3–inch (75-mm) sieve, 60-100 percent passing the 1/4–inch (6-mm) sieve, 0-50 percent passing the No. 40 sieve, and not more than 7 percent passing a No. 200 (0.075-mm) sieve. MDOT spec. 703.06 Type F.

I. Sand: ASTM C 33; fine aggregate.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 157 lbf (700 N); ASTM D 4632.
3. Sewn Seam Strength: 142 lbf (630 N); ASTM D 4632.
4. Tear Strength: 56 lbf (250 N); ASTM D 4533.
5. Puncture Strength: 56 lbf (250 N); ASTM D 4833.
6. Apparent Opening Size: No. 70 (0.212-mm) sieve, maximum; ASTM D 4751.
7. Permittivity: 0.2 per second, minimum; ASTM D 4491.
8. UV Stability: 70 percent after 500 hours' exposure; ASTM D 4355.

A. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 20 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf (1100 N); ASTM D 4632.
3. Sewn Seam Strength: 222 lbf (990 N); ASTM D 4632.
4. Tear Strength: 90 lbf (400 N); ASTM D 4533.
5. Puncture Strength: 90 lbf (400 N); ASTM D 4833.
6. Apparent Opening Size: No. 40 (0.430-mm) sieve, maximum; ASTM D 4751.
7. Permittivity: 0.05 per second, minimum; ASTM D 4491.
8. UV Stability: 70 percent after 500 hours' exposure; ASTM D 4355.

B. CONTROLLED LOW-STRENGTH MATERIAL

C. Controlled Low-Strength Material: Self-compacting, low-density, flowable concrete material produced from the following:
   1. Portland Cement: ASTM C 150, Type I.
   2. Fly Ash: ASTM C 618, Class C or F.
   3. Normal-Weight Aggregate: ASTM C 33, 3/8-inch (10-mm) nominal maximum aggregate size.
   4. Water: ASTM C 94/C 94M.
   5. Air-Entraining Admixture: ASTM C 260.

D. Produce conventional-weight, controlled low-strength material with 140-psi (965-kPa) compressive strength when tested according to ASTM C 495.

2.3 INSULATION BOARD

A. Extruded polystyrene with a "K" factor of 0.18, with 2.2 lb./cu. ft. density, and 30 psi compressive strength, manufactured by Dow Chemical, or approved equal. ASTM C 578, Type VI.

2.4 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored as follows:
   1. Red: Electric.
   2. Yellow: Gas, oil, steam, and dangerous materials.
   3. Orange: Telephone and other communications.
   4. Blue: Water systems.
   5. Green: Sewer systems.

B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:
   1. Red: Electric.
   2. Yellow: Gas, oil, steam, and dangerous materials.
   3. Orange: Telephone and other communications.
   4. Blue: Water systems.
   5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
   1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
   2. Water from construction dewatering operations shall be cleaned of sediment before reaching wetlands, water bodies, streams, or site boundaries. Conform to the requirements of the Department of Environmental Protection.

3.3 EXPLOSIVES

A. Explosives: Not Anticipated. If explosives are needed and are approved by Owner, obtain written permission from authorities having jurisdiction before bringing explosives to Project site or using explosives on Project site.
   1. Perform blasting without damaging adjacent structures, property, or site improvements.
   2. Perform blasting without weakening the bearing capacity of rock subgrade and with the least-practicable disturbance to rock to remain.

B. Rock excavation is not anticipated, however if encountered, ledge rock excavation cost shall be approved prior to excavation. Prior to blasting and rock excavation, provide survey grades of the top of the ledge surface, and calculations of the expected rock quantities to be excavated. Submit this data and obtain Architect's approval prior to proceeding with rock excavation. The Architect will determine the extent of rock excavation and classification.

3.4 EXCAVATION, GENERAL

A. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock.
   1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
      a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
   2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction.

B. If hazardous waste or special waste as defined by the U. S. Environmental Protection Agency or State Department of Environmental Protection is encountered during excavation, the Contractor shall avoid disturbance of that material, and shall notify the Owner immediately. The State Bureau of Oil and Hazardous Waste Control must be notified and consulted prior to disturbance of the waste or contaminated soil. Removal and disposal of contaminated materials is not

included in the Contract Bid, since it must be handled as directed by the regulatory agencies on a case-by-case basis.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections. Do not disturb bottom of excavations intended as bearing surfaces.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.
   1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line, unless pipe inverts are shown otherwise.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated.
   1. Clearance: As indicated.

C. Trench Bottoms: For ductile iron pipe, excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
   1. For pipes and conduit less than 6 inches (150 mm) in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
   2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
   3. Excavate trenches 8 inches (200 mm) deeper than bottom of pipe elevation in rock or other unyielding bearing material to allow for bedding course.

D. Trench Bottoms: For pipe materials other than ductile iron, excavate trenches 4 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
   1. Excavate trenches 8 inches (200 mm) deeper than bottom of pipe elevation in rock or other unyielding bearing material to allow for bedding course.

3.8 SUBGRADE INSPECTION

A. Notify Architect and Geotechnical Engineer when excavations have reached required subgrade.

B. If Geotechnical Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Geotechnical Engineer, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Architect.
   1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:
   1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
   2. Surveying locations of underground utilities for Record Documents.
   3. Testing and inspecting underground utilities.
   4. Removing concrete formwork.
   5. Removing trash and debris.
   6. Removing temporary shoring and bracing, and sheeting.
   7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Place and compact initial backfill of bedding course material, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.
   1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

D. Place and compact final backfill of satisfactory soil to final subgrade elevation.

E. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.13 INSULATION BOARD

A. Place a leveling course of sand, 2 inches (50 mm) thick, over subgrade. Finish leveling course to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.
   1. Place leveling course on subgrades free of mud, frost, snow, or ice.

B. Install insulation board in layers with abutting edges and ends along pipelines or other objects to be insulated.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
   1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
   2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 12 inches (300 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 6 inches (150 mm) in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
   1. Under structures, building slabs, steps, walkways, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 95 percent.
   2. Under lawns, turf, or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 90 percent.
   3. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.
   4. Compact crush stone to 100% of its dry rodded weight.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide a smooth transition between adjacent existing grades and new grades.
   2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
   1. Lawn, turf, or unpaved Areas: Plus or minus 1 inch (25 mm).
   2. Pavements and walks: Plus or minus 1/2 inch (13 mm).

3.17 SUBBASE AND BASE COURSES

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade or granular fill layer, place subbase course and base course under pavements and walks as follows:
   1. Where fill is required, place satisfactory soil or granular borrow fill on prepared subgrade.
   2. Place base course material over subbase course under hot-mix asphalt pavement, concrete pavement, and unit pavers.
   3. Shape subbase course and base course to required crown elevations and cross-slope grades.
   4. Place subbase course and base course 6 inches (150 mm) or less in compacted thickness in a single layer.
   5. Place subbase course and base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
   6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.18 FIELD QUALITY CONTROL

A. Testing Agency: If deemed necessary, the Owner will engage a qualified Geotechnical Engineering testing agency to perform field quality control testing and inspections.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
   1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 1000 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than three tests.
   2. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 100 feet (30 m) or less of trench length, but no fewer than two tests.

D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.19 LOAMING AND SEEDING

A. Topsoil: Topsoil for general site loam, except that existing on the site, will not be made available by the Owner. The Contractor shall be responsible for supplying any additional topsoil needed and hauling it to the site. It shall be obtained from naturally well drained areas. Whether from on-site or off-site source, the topsoil shall be a fertile, friable natural loam. ASTM D 5268 topsoil, with pH range of 5.5 to 7, a minimum of 5 percent organic material

content nor more than 15%; soluble salts less than 500 parts per million; free of stones 3/4 inch or larger in any dimension and other extraneous materials harmful to plant growth. Soil shall not be used for planting while in frozen or muddy condition. Unsuitable materials removed shall be disposed of by the Contractor.

B. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

C. Seed Species: State-certified seed of grass species, 85 percent pure seed, and not more than 0.25 percent weed seed:
   1. General Lawn Areas: Proportioned by weight as follows:
      a. 35 percent creeping red fescue.
      b. 30 percent chewings fescue.
      c. 35 percent perennial ryegrass

D. Sow seed at a total rate of 5 lb/1000 sq. ft. (2.3 kg/92.9 sq. m).

E. Sow 50% in one direction and 50% at right angles to the first seeding. Spread seed when soil is moist; lightly raked into top 1/8 inch of soil and rolled lightly in two directions.

F. Hydroseeding may be used in-lieu of hand seeding.

G. Take whatever measures are necessary to protect the seeded area while it is germinating. These measures shall include furnishing warnings signs, barriers, and other needed measures of protection.

H. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

   1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
   2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.

3.20 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
   1. Scarify or remove and replace soil material to depth as directed by Architect or Geotechnical Engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
   1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property. Comply with the requirements of Division 01 “Construction Waste Management”.

END OF SECTION 312000

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SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Saw-cutting or cold milling of existing asphalt pavement.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt paving.
4. Pavement marking paint

B. Related Requirements:
1. Section 312000 "Earth Moving" for subgrade preparation, fill material, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include technical data and tested physical and performance properties.
2. Job-Mix Designs: For each job mix proposed for the Work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and installer.

B. Material Certificates: For each paving material.

C. Material Test Reports: For each paving material, by a qualified testing agency.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of state in which Project is located.

B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the latest revision of "Standard Specifications for Highways and Bridges" of the State of Maine Department of Transportation (MDOT), for asphalt paving work.
   1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
   1. Tack Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
   2. Slurry Coat: Comply with weather limitations in ASTM D 3910.
   3. Asphalt Base Course: Minimum surface temperature of 40 deg F (4.4 deg C) and rising at time of placement.
   4. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.6 deg C) at time of placement.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D 692/D 692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

C. Fine Aggregate: ASTM D 1073, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.

   1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: AASHTO M 320, conform to MDOT specification Sec. 702.

B. Tack Coat: AASHTO M 140 emulsified asphalt, or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application. Emulsified asphalt conforming to MDOT 702.04.

C. Water: Potable.

2.3 AUXILIARY MATERIALS

A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; and recycled asphalt shingles from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.

B. Joint Sealant: ASTM D 6690 hot-applied, single-component, polymer-modified bituminous sealant.

C. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes.
   1. Color: White.
   2. 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. Sherwin-Williams Waterborne Traffic Paint, or equal.

2.4 MIXES

A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and complying with the following requirements:
   1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
   2. Roads and parking:
      a. Surface Course: Conforming to HMA 9.5mm. MDOT, Section 703.09.
      b. Binder Course: Conforming to HMA 19mm. MDOT, Section 703.09.
   3. Walks:
      a. Surface Course: Conforming to HMA 9.5mm. MDOT, Section 703.09.

Sieve Size	Percent by Weight Passing – Combined Aggregate		
	Type 19 mm (B)	Type 12.5 mm (C)	Type 9.5 mm (D)
25 mm (1”)	100		
19 mm (3/4”)	90-100	100	
12.5 mm (1/2”)	-90	90-100	100
9.5 mm (3/8”)	-	-90	90-100
4.75 mm (No. 4)	-	-	-90
2.36 mm (No. 8)	23-49	28-58	32-67
75 µm (No. 200)	2-8	2-10	2-10

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph (5 km/h).
2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

C. Proceed with paving only after unsatisfactory conditions have been corrected, and underground conduits and utilities have been completed.

3.2 PATCHING

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

C. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

3.3 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch (25 mm) in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches (75 mm) thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch (6 mm).

1. Clean cracks and joints in existing hot-mix asphalt pavement.
2. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.

3.4 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
3. Treat exposed existing horizontal and vertical pavement surfaces with sprayed bituminous tack coat prior to placing new adjacent or overlaying bituminous pavement. Pavement which has been in place longer than 30 days shall be considered existing.

3.5 PLACING HOT-MIX ASPHALT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
2. Spread mix at a minimum temperature of 250 deg F (121 deg C).
3. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
4. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches (25 to 38 mm) from strip to strip to ensure proper compaction of mix along longitudinal joints.
2. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.6 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches (150 mm).
3. Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."

5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.7 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 95 percent of reference laboratory density according to MDOT, but not less than 92.5 percent or greater than 97.5 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.8 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age for at least 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm). Apply sufficient thickness to completely

cover the underlying pavement with solid white(or yellow) lines, such that no pavement color shows through.

3.9 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch (13 mm).
2. Surface Course: Plus 1/4 inch (6 mm), no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 3/8 inch (9 mm).
2. Surface Course: 1/4 inch (6 mm).
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

C. Asphalt Traffic-Calming Devices: Compact and form asphalt to produce the contour indicated and within a tolerance of plus or minus 1/4 inch (6 mm) of height indicated above pavement surface.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections. This will not relieve the Contractor of his quality control responsibilities

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Alignment: Pavement edges shall be in conformance to alignment with straight edges or smooth curved edges, without irregularities or ragged edges.

D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

E. Asphalt Traffic-Calming Devices: Finished height of traffic-calming devices above pavement will be measured for compliance with tolerances.

F. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to MDOT specifications.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.

a. One core sample will be taken for every 1000 sq. yd. (836 sq. m) or less of installed pavement, with no fewer than three cores taken.
b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

G. Replace and compact hot-mix asphalt where core tests were taken.

H. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.11 WASTE HANDLING

A. General: Handle asphalt-paving waste according to approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."

END OF SECTION 321216

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Exterior equipment pads on grade.

B. Exterior cast-in-place concrete equipment pad material, forming, and placement is covered under Division 03, and is NOT included in Division 32. Site preparation, grading, soil fill materials, and compaction are included in Divisions 31 and 32. (Buried concrete items, such as posts, thrust-blocking, pipe encasement, and temporary concrete are included wholly in Divisions 31, 32, and 33).

C. Related Sections:
   1. Division 03 Section "Cast-in-Place Concrete" for general building applications of concrete.
   2. Division 31 Section "Earth Moving" for subgrade preparation, grading, and subbase course.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 ACTION SUBMITTALS

A. Shop Drawings: Indicate construction joint and control joint layout and details.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified ready-mix concrete manufacturer and installer.

B. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

C. ACI Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.

D. Preinstallation Conference: Conduct conference at Project site in accordance with requirements of Section 013100.

1. Review methods and procedures related to concrete paving, including but not limited to, the following:

a. Concrete mixture design.
b. Quality control of concrete materials and concrete paving construction practices.
c. Control joints layout and details.

PART 2 - PRODUCTS

2.1 CONCRETE PAVEMENTS AND INCIDENTALS

A. Materials: Specified in Division 03.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph (5 km/h).
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).

3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch (13 mm) according to requirements in Section 312000 "Earth Moving."

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

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

B. Prepare for concrete conforming to design and joint layout shown on the Drawings, of uniform color and texture throughout, and conforming to Division 03 specifications. Concrete material, formwork, and placement is NOT included in Division 32.

3.3 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

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SECTION 323113 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Chain-link fences.
2. Gates: swing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1. Fence and gate posts, rails, and fittings.
2. Chain-link fabric, reinforcements, and attachments.
3. Gates and hardware.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to proposed and existing structures. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:

1. Fabric Height: As indicated on Drawings.
2. Steel Wire Fabric: Nine-gauge wire with a diameter of 0.148 inch (3.76 mm); measured with zinc coating, but before polymer coating is applied.

a. Mesh Size: 2 inches (50 mm).
b. Polymer-Coated Fabric: ASTM F 668, Class 2b over zinc-coated steel wire.

1) Color: Black, complying with ASTM F 934.

3. Selvage: Knuckled at both selvages.

2.2 FENCE FRAMING

A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on the following:

1. Fence Height: As indicated on Drawings.
2. Light Industrial Strength: Material Group IC-L, round steel pipe, electric-resistance-welded pipe.

3. Horizontal Framework Members: top and bottom rails complying with ASTM F 1043.

   a. Top and Bottom Rail: 1.66 inches (42 mm) in diameter.

4. Brace Rails: Comply with ASTM F 1043.
5. Metallic Coating for Steel Framing:
   a. External, Type B, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. (0.27 kg/sq. m) of zinc after welding, a chromate conversion coating, and a black polymer film to match fence fabric. Internal, Type D, consisting of 81 percent, not less than 0.3-mil- (0.0076-mm-) thick, zinc-pigmented coating.
6. Polymer coating over metallic coating.
   a. Color: Match chain-link fabric, complying with ASTM F 934.

B. Posts, Top Rails, Bottom Rails, Braces, Gate Posts and Rails – Meet the following dimensions:

C.

USE AND SECTION	OUTSIDE DIAMETER NOMINAL INCHES
End, corner and pull posts (tubular) fabric height 6'-0" and less	2.375
Over 6'-0"	2.875
Gate posts for nominal width of gate, single or one leaf of double gate width 6'-0" or less	2.875
Over 6'-0" to 13'-0"	4.00
Over 13'-0" to 18'-0"	6.625
Over 18'-0"	8.625
Gate frames 6'-0" or less in height - 8'-0" or less in width	1.660
Gate frames over 6'-0" in height - over 8'-0" in width	1.90

Rails and post braces	1.66
INTERMEDIATE POSTS FOR FABRIC HEIGHTS	
6'-0" and less	1.90
Over 6'-0"	2.375”

2.3 SWING GATES

A. General: Comply with ASTM F 900 for gate posts and single or double swing gate types.

1. Gate Leaf Width: As indicated.
2. Gate Fabric Height: As indicated.
3. Fabric type and color: Match fence fabric.

B. Pipe and Tubing:

1. Zinc-Coated Steel with polymer coating: Comply with ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framing.
2. Gate Posts: Round tubular steel.
3. Gate Frames and Bracing: Round tubular steel.

C. Frame Corner Construction: assembled with corner fittings.

D. Hardware:

1. Hinges: As indicated; 360-degree inward and outward swing.
2. Latches permitting operation from both sides of gate, with provision for padlocking accessible from both sides of gate.
3. Padlock: Owner-furnished.

2.4 FITTINGS

A. General: Comply with ASTM F 626.

B. Post Caps: Provide for each post.

1. Provide line post caps with loop to receive tension wire or top rail.

C. Rail and Brace Ends: For each gate, corner, pull, and end post.

D. Fittings: Provide with black polymer coating.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 INSTALLATION, GENERAL

A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.

3.3 CHAIN-LINK FENCE INSTALLATION

A. Post Setting: Set posts by mechanically driving into soil at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing.
2. Set gate posts, terminal posts, and corner posts in flanged fittings on concrete slab, as shown on the drawings.

B. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of as indicated on Drawings.

C. Line Posts: Space line posts uniformly.

D. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at midheight of fabric 72 inches (1830 mm) or higher, on fences with top rail and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

E. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- (3.05-mm-) diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches (610 mm) o.c. Install tension wire in locations indicated before stretching fabric.

F. Top and Bottom Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

G. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2 inches (50 mm) between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

H. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches (380 mm) o.c.

I. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches (300 mm) o.c. and to braces at 24 inches (610 mm) o.c.

J. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Adjust hardware for smooth operation and lubricate where necessary.

3.5 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

END OF SECTION 323113

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