PROJECT MANUAL

Issued For Construction: December, 2019

CCRI CHILLER REPLACEMENT NEWPORT CAMPUS

ONE JOHN H. CHAFEE BLVD
NEWPORT, RHODE ISLAND 02840

AHARONIAN & ASSOCIATES, INC. - ARCHITECTS

310 George Washington Highway - Suite 100 - Smithfield, Rhode Island 02917 T 401-232-5010 F 401-232-5080

MEP ENGINEER

Andre Gill Engineering
40 Overlea Road
North Smithfield, RI
02896
T: 401-441-3414

AHARONIAN & ASSOCIATES INC. - ARCHITECTS

310 George Washington Highway - Suite 100 - Smithfield, Rhode Island 02917 T 401-232-5010 F 401-232-5080

CCRI CHILLER REPLACEMENT

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Newport, Rhode Island 02840 **AA# 19160**

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310 George Washington Highway - Suite 100 - Smithfield, Rhode Island 02917 T 401-232-5010 F 401-232-5080

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Newport Campus
Newport, Rhode Island 02840 AA# 19160

DOCUMENT 00 01 15

LIST OF DRAWING SHEETS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified in this Document.

1.02 REFERENCE

A. The Drawings hereinafter listed represents an integral part of the Contract Documents. They should not be considered as a separate entity, as along with the technical specifications, form a process of disseminating information required to perform the Work of this Project.

B. The Drawings may be issued in multiple packages or phases. The Schedule below will be modified as these packages are issued.

1.03 SCHEDULE

A. The following schedule indicates the Drawings of this Contract. The manner of listing and respective order are for convenience only and do not obligate the Contractor to perform the Work in any specific sequence. The work indicated on each drawing should not be construed as specific work for a specific trade, subcontractor or supplier.

B. SCHEDULE OF DRAWINGS:

Number	Title
CS	COVER SHEET
D1.1	DEMOLITION FLOOR PLAN & DETAILS
A1.1	FLOOR PLAN & DETAILS
M0.01	MECHANICAL GENERAL
M1.01	MECHANICAL PLAN FLOOR - EXISTING
M1.02	MECHANICAL PLANS - DEMO
M1.03	MECHANICAL PLANS - NEW
M5.00	MECHANICAL DETAILS
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M7.00	MECHANICAL CONTROLS
M7.01	MECHANICAL CONTROLS HEATING
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M9.01	MECHANICAL 3D VIEW
E0.01	ELECTRICAL GENERAL
E1.01	ELECTRICAL PLANS

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTIONS (Not Applicable)

END OF DOCUMENT 00 01 15

DOCUMENT 00 43 13
BID SECURITY FORM

AIA DOCUMENT A310 – Latest Edition
BID BOND

Document bound herewith. Failure to review this document will not relieve parties of the contractual requirements contained herein.

END OF DOCUMENT 00 43 13

AIA® Document A310™ – 2010

Bid Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

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

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

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

OWNER:
(Name, legal status and address)
State of Rhode Island, acting by ad through the Department of Administration,
Division of Purchases, on behalf of the User Agency
One Capitol Hill, Second Floor
Providence, RI 02908+5855
401-578-81—(telephone) WWW.ridop.ri.gov

BOND AMOUNT: $

PROJECT:
(Name, location or address, and Project number, if any)
CCRI Chiller Replacement - Newport Campus
One John H. Chafee Blvd
Newport, RI 02840

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

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

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or

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User Notes: (1263814739)

legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

Signed and sealed this day of ,

	(Contractor as Principal) *(Seal)*
(Witness)	*(Title)*
	(Surety) *(Seal)*
(Witness)	*(Title)*

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DOCUMENT 00 52 00
AGREEMENT FORM

AIA DOCUMENT A101 - 2017 Edition
ABBREVIATED STANDARD FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR FOR CONSTRUCTION PROJECTS OF LIMITED SCOPE WHERE THE BASIS OF PAYMENT IS A STIPULATED SUM AS MODIFIED BY STATE PURCHASING

Document bound herewith. Failure to review this document will not relieve parties of the contractual requirements contained herein.

END OF DOCUMENT 00 52 00

AIA® Document A101™ – 2017

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

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

BETWEEN the Owner:
(Name, legal status, address, telephone and facsimile numbers, and website)

State of Rhode Island, acting by and through the Department of Administration, Division of Purchases, on behalf of the User AgencyOne Capitol Hill, Second Floor Providence, Rhode Island 02908-5855
401.578.8100 (telephone); 401.574.8387 (facsimile)
www.puchasing.ri.gov

on behalf of the User Agency:
(Name, legal status, address, telephone and facsimile numbers, and website)

Community College of Rhode Island - Newport Campus
One John H. Chafee Blvd.
Newport, RI 02840
401-825-2380

and the Contractor:
(Name, legal status, address, telephone and facsimile numbers, and website)

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

Community College of Rhode Island - Newport Campus
One John H. Chafee Blvd.
Newport, RI 02840
401-825-2380

The Design Agent:
(Name, legal status, address, telephone and facsimile numbers, and website)

Aharonian & Associates, Inc.
310 George Washington Highway, Suite 100
Smithfield, RI 02917
401-232-5010

The Owner and Contractor agree as follows.

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

The parties should complete A101™–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201™–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

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The Owner and Contractor agree as follows.
(Paragraph Deleted)

TABLE OF ARTICLES

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2 THE WORK OF THIS CONTRACT

3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

4 CONTRACT SUM

5 PAYMENTS

6 DISPUTE RESOLUTION

7 TERMINATION OR SUSPENSION

8 MISCELLANEOUS PROVISIONS

9 ENUMERATION OF CONTRACT DOCUMENTS

EXHIBIT A INSURANCE AND BONDS

ARTICLE 1 THE CONTRACT DOCUMENTS
The Contract Documents consist of this Agreement, Conditions of the Contract (General Conditions, Supplementary Conditions (if any), and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT
The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others. No part of the Work shall be performed by Subcontractors without the Owner's prior written consent.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION
§ 3.1 The date of commencement of the Work shall
be the later of: (i) the issuance of the Purchase Order by the Owner; and (ii) the
(Paragraph Deleted)

date set forth in a notice to proceed issued by the User Agency.

(Paragraphs Deleted)

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

§ 3.3 Substantial Completion
§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:
(Check one of the following boxes and complete the necessary information.)

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[ ] Not later than ( ) calendar days from the date of commencement of the Work.

[ ] By the following date:

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. Subject to additions and deductions as provided in the Contract Documents, the Contract Sum shall be: $_____.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.3 Allowances, if any, are specified in the Bid Proposal Form and are included in the Contract Sum.

(Paragraph Deleted)

(Table Deleted)

§ 4.4 Unit prices, if
any, are specified in the Bid Proposal Form and include all costs, including without limitation, labor, materials, services, regulatory compliance, overhead, and profit necessary for the completion of the Work. Unit prices shall be used for both additions to, and deletions from the Work.

(Table Deleted)

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

.1 In the event that there is one date for Substantial Completion of the Work, the Contractor shall pay the Owner the sum stipulated in this Section 4.5.1 as liquidated damages, and not as a penalty, for each calendar day of delay until the Work is substantially complete: $_____.

.2 In the event that the Project is scheduled to be completed in phases, and there is more than one date for Substantial Completion of the Work, the Contractor shall pay the Owner an aggregate amount equal to the sums

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stipulated in this Section 4.5.2 as liquidated damages, and not as a penalty, for each calendar day of delay until the Work for each phase is substantially complete:

Phase **Liquidated Damages Sum**

.3 The Owner and the Contractor have reasonably determined the sums set forth in this Section 4.5 to be a fair estimate of the Owner' actual damages which are difficult to ascertain in the event of delay.

§ 4.6 Other:
The Owner shall not be liable to the Contractor or any Subcontractor for claims or damages of any nature caused by or arising out of any delays. The sole remedy against the Owner for delays shall be the allowance of additional time for completion of the Work.

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

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

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month.

§ 5.1.3 The Owner shall make payment of the certified amount, less retainage, to the Contractor not later than the 30th working day following written approval by the Owner.

(Paragraph Deleted)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor and approved by the Design Agent and the Owner in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Design Agent and the Owner may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

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

§ 5.1.6 In accordance with AIA Document A201™–2007, General Conditions of the Contract for Construction as modified by the Owner, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

.1 That portion of the Contract Sum properly allocable to completed Work;

.2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and

.3 That portion of Construction Change Directives that the Design Agent determines, in the Design Agent's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

.1 The aggregate of any amounts previously paid by the Owner;

.2 The amount, if any, for Work that remains uncorrected and for which the Design Agent has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2007 as modified by the Owner;

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.3 For Work performed or defects discovered since the last payment application, any amount for which the Design Agent may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2007 as modified by the Owner; and

.4 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due: five (5%) percent.

(Paragraph Deleted)

§ 5.1.7.1.1 Deleted.

(Paragraph Deleted)

§ 5.1.7.2 Deleted.

(Paragraph Deleted)

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:
The amount of five (5%) percent shall be retained by the Owner through the date of Substantial Completion of the Work and then after the date of Substantial Completion of the Work in accordance with R.I. Gen. Laws § 37-12-10.1.

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2007 as modified by the Owner.

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

§ 5.1.10 Within 10 working days of receipt of any progress payment from the Owner, the Contractor must pay its Subcontractors the full amount included for each such Subcontractor within the Contractor's Application for Payment in accordance with the provisions of AIA A201 – 2007, General Conditions of the Contract for Construction as modified by the
(Paragraph Deleted)

Owner.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, less the amount withheld pursuant to § 5.1.7.3, shall be made by the Owner to the Contractor when:

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2007 as modified by the Owner, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by the Design Agent and approved in writing by the Owner;

.3 the Contractor has submitted its final release and final releases from all of its Subcontractors and suppliers in a form acceptable to the Owner; and

4 the Contractor has submitted to the Owner all close-out documents, including without limitation, all as-built plans, warranties, manuals, and other materials set forth in the Contract Documents.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 working days after the issuance of the Design Agent's final Certificate for

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Payment and written approval by the Owner.

§ 5.3 Interest
Payments due and unpaid under the Contract shall bear interest from the date payment is due in accordance with the provisions of "Prompt Payment by Department of Administration," R.I. Gen. Laws §§ 42-11.1-1 et seq.

§ 5.4 Owner's Rights
§ 5.4.1 The Owner shall have the right to deduct from any payments due to the Contractor the amount of any unpaid obligations owed to the State of Rhode Island by the Contractor, including without limitation, any and all unpaid taxes, the amount of any claim against the Contractor arising out of this Agreement, or any amount on account of any other reason permitted by applicable law.

§ 5.5 Pursuant to R.I. Gen. Laws § 44-1-6, the Owner shall withhold payment from the Contractor if the Contractor does not maintain a regular place of business in Rhode Island in the amount of three (3%) percent of the Contract Sum until 30 calendar days after Final Completion and compliance by the Contractor with the requirements of such section. The three (3%) percent withheld pursuant to R.I. Gen. Laws § 44-1-6 is not considered retainage which is held pursuant to § 5.1.7.

(Paragraph Deleted)

ARTICLE 6 DISPUTE RESOLUTION
§ 6.1 Initial Decision Maker
Claims shall be referred to the Initial Decision Maker for initial decision. The Purchasing Agent appointed pursuant to the provisions of the "State Purchases Act," R.I. Gen. Laws § 37-2-1 et seq., will serve as the Initial Decision *Maker in accordance with the provisions of the State Purchases Act, State of Rhode Island Procurement Regulations, and this Section 6.1. An initial decision shall be required as a condition precedent to binding dispute resolution pursuant to Section 6.3 of any Claim arising prior to the date final payment is due.*

§ 6.2 Mediation
For any Claim not resolved by the Initial Decision Maker procedures set forth in Section 6.1, and prior to the implementation of the binding dispute resolution procedures set forth in Section 6.3, the Contractor shall *have the*
option to pursue mediation, exercisable by written notice to the Owner within 30 calendar days of an Initial Decision. In the event of the exercise of
such option by the Contractor, the Owner and the Contractor shall attempt to select a mediator, and in the event that the Owner and the Contractor cannot agree on a mediator, either party may apply in writing to the Presiding Justice of the Providence County Superior Court, with a copy to the other, with a request for the court to appoint a mediator, and the costs of the mediator shall be borne equally by both parties.

(Paragraph Deleted)

§ 6.3 Binding Dispute Resolution
For any Claim not resolved by the Initial Decision Maker procedures set forth in Section 6.1, or mediation at the option of the Contractor pursuant to Section 6.2, the method of binding dispute resolution shall be determined in accordance with the provisions of the "Public Works Arbitration Act," R.I. Gen. Laws §§ 37-16-1 et seq.

ARTICLE 7 TERMINATION OR SUSPENSION
§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document

A201–2007, as modified by the Owner. The Contract may also be terminated by the Owner: (i) in the event of the unavailability of appropriated funds; (ii) in the absence of a determination of continued need; or (iii) as *otherwise provided in the State of Rhode Island Procurement Regulations General Conditions of Purchase or other applicable law.*

§ 7.1.1 Deleted.

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§ 7.2 The Work may be suspended by the Owner as provided in: (i) the State of Rhode Island General Conditions of Purchase Regulation or other applicable law; or (ii) Article 14 of AIA Document A201–2007 as modified by the Owner.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2007 or another Contract Document, the reference refers to: (i) the AIA Document A201 – 2007 or other Contract Document as modified by the Owner; and (ii) that provision in the AIA Document A201 – 2007 as modified by the Owner or other Contract Document as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 Representatives for the Owner

§ 8.2.1 The Owner's representative:
(Name, title, address, email address, and other information for the preferred methods of contact)

§ 8.2.2 The User Agency's representative:
(Name, title, address, email address, and other information for the preferred methods of contact)

§ 8.2.3 The Design Agent's representative:
(Name, title, address, email address, and other information for the preferred methods of contact)

§ 8.3 The Contractor's representative:
(Name, title, address, email address, and other information for the preferred methods of contact)

§ 8.4 Neither the Owner's nor the Contractor's representative nor the Design Agent's representative shall be changed without 10 working days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in the Solicitation and elsewhere in the Contract Documents.

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§ 8.5.2 The Contractor shall provide bonds as set forth in the Solicitation and elsewhere in the Contract Documents.

§ 8.6 Deleted.

§ 8.7 Other provisions:
§ 8.7.1 The Contractor represents and warrants to the Owner, in addition to any other representations and warranties of the Contractor elsewhere in the Contract Documents:

.1 The Contractor and its Subcontractors are each financially solvent, able to pay their debts as they mature, and possess sufficient working capital to perform their obligations under the Contract Documents.
.2 The Contractor and its Subcontractors are each able to furnish the tools, materials, equipment, and labor required to complete the Project as required under the Contract Documents.
.3 *The Contractor and each Subcontractor are authorized to do business in the State of Rhode Island and are properly licensed by all necessary governmental authorities having jurisdiction over them and over the Work and the Project.*
.4 The execution of this Agreement and its performance is within its duly authorized powers.
.5 The Contractor has visited the site of the Project, familiarized itself with the local and special conditions under which the Work is to be performed, and correlated its observations with the requirements of the Contract Documents.
.6 The Contractor possesses the requisite level of experience and expertise in the business administration, construction, and superintendence of projects of the size, complexity, and nature of the Project, and it will perform the Work with the care, skill, and diligence of a contractor possessing such experience and expertise.

§ 8.7.2 The representations and warranties of the Contractor in this Section 8.7 and elsewhere in the Contract Documents will survive the execution and delivery of this Agreement, any termination of this Agreement, and the final completion of the Work.

§ 8.7.3 Any Change Orders or other Modifications must be approved in writing by the Owner.

§ 8.7.4 The Owner is the State of Rhode Island, acting by and through its Department of Administration, Division of Purchases, and therefore, pursuant to the provisions of R.I. Gen. Laws § 34-28-31, mechanics liens may not be placed against the Project.

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS
§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor, as modified by the Owner
.2 Deleted.
.3 AIA Document A201™–2007, General Conditions of the Contract for Construction, as *modified by the* Owner.
.4 Deleted.
.5 Drawings

The Drawings are included in the Solicitation and are available on the Division of Purchases website at www.purchasing.ri.gov.

(Table Deleted)

.6 Specifications

(Table Deleted)

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The Specifications are included in the Solicitation and are available on the Division of Purchases website at www.purchasing.ri.gov.

.7 Addenda, if

(Table Deleted)

any, issued pursuant to the Solicitation form a part of the Solicitation and are available on the Division of Purchases website at www.purchasing.ri.gov.

.8

Supplementary and other Conditions of the Contract, including without limitation, the State of Rhode Island General Conditions of Purchase Regulation.

.9 Other documents listed below:

(Paragraph Deleted)

.1 The Solicitation, issued by the Owner, including without limitation, the Invitation to Bid, the Instructions to Bidders, the Specifications and Drawings, any Addenda, and the Bid Checklist.

(Paragraph Deleted)

.2 The Bid Proposal, including without limitation, the Bid Form and the Bidder Certification Cover Form.

(Table Deleted)

.3 The Purchase Order issued by the Owner.

§ 9.2 This Agreement and the Contract Documents are subject to, and governed by, the laws of the State of Rhode Island, including all procurement statutes and regulations (available at www.purchasing.ri.gov), and applicable federal and local law, all of which are fully incorporated into this Agreement by this reference.

(Table Deleted)

(Paragraph Deleted)

§ 9.3 *In the event of any conflict between or among the Contract Documents, or any Contract Documents and any provision of the State of Rhode Island Procurement Regulations and/or any other provision of the Rhode Island General Laws, the State of Rhode Island Procurement Regulations and the Rhode Island General Laws shall control.*

ARTICLE 10 BENEFITS OF AGREEMENT

§ 10.1 The User Agency is a disclosed third-party beneficiary of this Agreement and shall have all of the rights and benefits hereunder to which such a party is entitled. Nothing contained in this Agreement shall create a contractual relationship with, or a cause of action in favor of, any other third party against the Owner or the User Agency.

§ 10.2 This Agreement shall be binding on the Contractor and its successors and assigns; provided, however, that the Contractor may not assign its rights nor delegate its responsibilities under this Agreement without the Owner's prior written consent.

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This Agreement is entered into as of the day and year first written above; provided, however, that this Agreement shall not become a valid, binding, and enforceable contract unless and until the Owner shall have issued a Purchase Order.

THE STATE OF RHODE ISLAND,acting by and through its Department of Administration, Division of Purchases

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

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DOCUMENT 00 61 13
PERFORMANCE AND PAYMENT BOND FORM

AIA DOCUMENT A312 – Latest Edition
PERFORMANCE AND PAYMENT BOND

Document bound herewith. Failure to review this document will not relieve parties of the contractual requirements contained herein.

END OF DOCUMENT 00 61 13

AIA® Document A312™ – 2010

Performance Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

State of Rhode Island, acting by and through the Department of Administration
Division of Purchases, on behalf of the User Agency
One Capitol Hill, Second Floor

Providence, RI 02908

CONSTRUCTION CONTRACT
Date:
Amount: $ 0.00
Description:
(Name and location)
CCRI Chiller Replacement - Newport Campus

BOND
Date:
(Not earlier than Construction Contract Date)

Amount: $
Modifications to this Bond: None See Section 16

CONTRACTOR AS PRINCIPAL
Company: *(Corporate Seal)*
Signature:
Name and Title:

SURETY
Company: *(Corporate Seal)*
Signature:
Name and Title:

(Any additional signatures appear on the last page of this Performance Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)
AGENT or **BROKER:**

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

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

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

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

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User Notes:

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after

.1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

.2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

.3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

§ 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

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§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

.2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and

.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

§ 8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

§ 9 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.

§ 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 Definitions

§ 14.1 Balance of the Contract Price. The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 14.2 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

§ 14.3 Contractor Default. Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

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§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	
Address:		Address:	

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User Notes: (3B9ADA4E)

AIA® Document A312™ – 2010

Payment Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

The State of Rhode Island, acting by and through the Department of Administration
Division of Purchases, on behalf of the User Agency
One Capitol Hill, Second Floor

Providence, RI 02908

CONSTRUCTION CONTRACT
Date:
Amount: $ 0.00
Description:
(Name and location)
CCRI Chiller Replacement - Newport Campus

BOND
Date:
(Not earlier than Construction Contract Date)

Amount: $
Modifications to this Bond: None See Section 18

CONTRACTOR AS PRINCIPAL
Company: *(Corporate Seal)*
Signature:

Name and Title:

SURETY
Company: *(Corporate Seal)*
Signature:

Name and Title:

(Any additional signatures appear on the last page of this Payment Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)
AGENT or **BROKER:**

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

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

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

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

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User Notes:

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

.1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

.2 have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

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User Notes:

§ 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum:

- **.1** the name of the Claimant;
- **.2** the name of the person for whom the labor was done, or materials or equipment furnished;
- **.3** a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
- **.4** a brief description of the labor, materials or equipment furnished;
- **.5** the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- **.6** the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
- **.7** the total amount of previous payments received by the Claimant; and
- **.8** the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

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§ 16.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 16.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 18 Modifications to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	
Address:		Address:	

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SECTION 00 62 16
ACORD CERTIFICATE OF INSURANCE FORM

AIA DOCUMENT G715 Latest Edition
ACORD CERTIFICATE OF INSURANCE FORM

Document is bound herewith. Failure to review this document will not relieve parties of the contractual requirements contained herein.

END OF DOCUMENT 00 62 16

AIA® Document G715™ – 2017

Supplemental Attachment for ACORD Certificate of Insurance 25

PROJECT: *(name and address)*
CCRI Chiller Replacement - Newport Campus
One John H. Chafee Blvd
Newport, RI 02840

CONTRACT INFORMATION:
Contract For: General Construction

Date:

CERTIFICATE INFORMATION:
Producer:

Insured:
Date:

OWNER: *(name and address)*
State of Rhode Island, acting by and through the Department of Administration, Division of Purchases, on behalf of the User Agency
One Capitol Hill, Second Floor
Providence, RI 02908

ARCHITECT: *(name and address)*
Aharonian & Associates, Inc.
310 George Washington Highway, Suite 100
Smithfield, RI 02917

CONTRACTOR: *(name and address)*

A. General Liability	**Yes**	**No**	**N/A**
1. Does this policy include coverage for:			
a Damages because of bodily injury, sickness, or disease, including occupational sickness or disease, and death of any person?	☐	☐	☐
b Personal injury and advertising injury?	☐	☐	☐
c Damages because of physical damage to or destruction of tangible property, including the loss of use of such property?	☐	☐	☐
d Bodily injury or property damage arising out of completed operations?	☐	☐	☐
e The Contractor's indemnity obligations included in the Contract Documents?	☐	☐	☐
2. Does this policy contain an exclusion or restriction of coverage for:			
a Claims by one insured against another insured, where the exclusion or restrictions is based solely on the fact that the claimant is an insured, and there would otherwise be coverage for the claim?	☐	☐	☐
b Claims for property damage to the Contractor's Work arising out of the products-completed operations hazard where the damaged Work or the Work out of which the damage arises was performed by a Subcontractor?	☐	☐	☐
c Claims for bodily injury other than to employees of the insured?	☐	☐	☐
d Claims for the Contractor's indemnity obligations included in the Contract Documents arising out of injury to employees of the insured?	☐	☐	☐
e Claims for loss excluded under a prior work endorsement or other similar exclusionary language?	☐	☐	☐
f Claims or loss due to physical damage under a prior injury endorsement or similar exclusionary language?	☐	☐	☐
g Claims related to residential, multi-family, or other habitational projects?	☐	☐	☐
h Claims related to roofing?	☐	☐	☐
i Claims related to exterior insulation finish systems, synthetic stucco, or similar exterior coatings or surfaces?	☐	☐	☐
j Claims related to earth subsistence or movement?	☐	☐	☐
k Claims related to explosion, collapse, and underground hazards?	☐	☐	☐

B. Other Insurance Coverage	**Yes**	**No**	**N/A**

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1. Indicate whether the Contractor has the following insurance coverages and, if so, indicate the coverage limits for each.

a	Professional liability insurance Coverage limits:	☐	☐	☐
b	Pollution liability insurance Coverage limits:	☐	☐	☐
c	Insurance for maritime liability risks associated with the operation of a vessel Coverage limits:	☐	☐	☐
d	Insurance for the use or operation of manned or unmanned aircraft Coverage limits:	☐	☐	☐
e	Property insurance Coverage limits:	☐	☐	☐
f	Railroad protective liability insurance Coverage limits:	☐	☐	☐
g	Asbestos abatement liability insurance Coverage limits:	☐	☐	☐
h	Insurance for physical damage to property while it is in storage and in transit to the construction site Coverage limits:	☐	☐	☐
i	Other:	☐	☐	☐

_____
(Authorized Representative)

_____
(Date of Issue)

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DOCUMENT 00 65 20
RELEASE OF LIENS

AIA DOCUMENT G706A – Latest Edition
Release of Liens

Document bound herewith. Failure to review this document will not relieve parties of the contractual requirements contained herein.

END OF DOCUMENT 00 65 20

AIA® Document G706™ – 1994

Contractor's Affidavit of Payment of Debts and Claims

PROJECT: *(Name and address)*
CCRI Chiller Replacement - Newport Campus
One John H. Chafee Blvd.
Newport, RI 02840

ARCHITECT'S PROJECT NUMBER:
AA# 19160

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

CONTRACT FOR: General Construction
CONTRACT DATED:

TO OWNER: *(Name and address)*
The State of Rhode Island acting by and through the Department of Administration, Division of Purchases, on behalf of the User Agency
One Capitol Hill, Second Floor
Providence, Rhode Island 02908-5855

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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SECTION 00 72 00
GENERAL CONDITIONS

AIA DOCUMENT A201 - 2007 Edition
GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION AS MODIFIED BY STATE PURCHASING

Document is bound herewith. Failure to review this document will not relieve parties of the contractual requirements contained herein.

END OF DOCUMENT 00 72 00

AIA® Document A201™ – 2007

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)
A & E Chiller Replacement Project – Newport Campus
Community College Of Rhode Island – Newport Campus
One John H. Chafee Blvd.
Newport, RI 02840

THE OWNER:
(Name, legal status and address)
The State of Rhode Island, acting by and through the Department of Administration
Division of Purchases, on behalf of the User Agency
One Capitol Hill, Second Floor
Providence, Rhode Island 02908-5855
(401) 574-8100 (telephone)
(401 574-8387 (facsimile)
www.ridop.ri.gov
THE USER AGENCY

(Name, address, telephone and facsimile numbers, and web address)

Community College Of Rhode Island – Newport Campus
One John H. Chafee Blvd.
Newport, RI 02840
401-825-2380

THE Design Agent:
(Name, legal status, address, telephone and facsimile numbers, and web address)
Aharonian & Associates, Inc.
310 George Washington Highway, Suite 100
Smithfield, RI 02917
401-232-5010

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.

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(Paragraphs Deleted)

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 (the Agreement) and consist of the Agreement (and the documents enumerated therein), Conditions of the Contract (General Conditions, Supplementary Conditions, if any, 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 Design Agent.

§ 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 Design Agent or the Design Agent's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Design Agent or the Design Agent's consultants or (4) between any persons or entities other than the Owner and the Contractor. The Design Agent shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Design Agent'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 Design Agent and the Design Agent'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 and services 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; the Contractor shall perform all work reasonably inferable from the Contract Documents as being necessary to produce the indicated results.

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§ 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.

§ 1.2.4 In the event of any conflicts or discrepancies among the Contract Documents, the provisions of the Contract Documents will be interpreted in the following order of priority:

.1 Written modifications (if any).
.2 The Purchase Order.
.3 The AIA Documents, as modified by the Owner.
.4 The Supplementary Conditions (if any).
.5 The Bid Proposal.
.6 The Solicitation, including any Addenda, and the Specifications and Drawings

§ 1.2.5 In the event of any conflicts or discrepancies between the Contract Documents and the State of Rhode Island Procurement Regulations or any provision of the Rhode Island General Laws, the State of Rhode Island Procurement Regulations and the Rhode Island General Laws will control.

§ 1.2.6 In the event of any inconsistency between the Drawings and Specifications, the better quality or greater quantity of Work shall be provided.

§ 1.2.7 The Owner will be the final decision maker for any and all interpretations.

§ 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 Owner and the User Agency shall have a perpetual license to utilize the Drawings, Specifications, and other documents, including electronic or digital documents, prepared by the Design Agent and the Design Agent’s consultants, for the execution of the Project and shall have and retain all rights to use them and reproduce them for the production and maintenance of the Work described therein. 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 Design Agent’s or Design Agent’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, Design Agent and the Design Agent’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

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§ 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 Design Agent does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 Deleted.

§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 2.2.1 Deleted.

§ 2.2.2 The Contractor shall secure and pay for permits and fees, 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 If required for the Work in the discretion of the Owner, 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 any 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 Deleted.

§ 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 10 working-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 Design Agent'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 Design Agent. 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. 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.

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§ 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 Design Agent, 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 Owner and the Design Agent any errors, inconsistencies, or omissions discovered by or made known to the Contractor or additional Drawings, Specifications, or instructions required to define the Work in greater detail to permit the proper progress of the Work as a request for information in such form as the Design Agent 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 Design Agent and the Owner any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Design Agent or Owner may require.

§ 3.2.3.1 Omissions from the Drawings and Specifications of items obviously needed to perform the Work properly, such as attachments, bolts, hangers, and other fastening devices, shall not relieve the Contractor from the obligation to furnish and install such items.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Design Agent 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, 3.2.3, or 3.2.3.1, 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 Design Agent 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.

§ 3.2.4.1 The Contractor shall not make any changes without prior written authorization from the Design Agent and the Owner.

§ 3.2.5 The Owner is entitled to reimbursement from the Contractor for amounts paid to the Design Agent for evaluating and responding to the Contractor's requests for information that are not prepared in accordance with the Contract Documents or where the requested information is available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared coordination drawings, or prior Project correspondence or
(Paragraph Deleted)

documentation.

§ 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

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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 Design Agent and shall not proceed with that portion of the Work without further written instructions from the Design Agent. 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. Whenever the Contractor has an obligation to provide labor and materials under the Agreement, the Contractor, at a minimum, shall provide the labor for, and furnish and install and place in operation all items, including without limitation, all proper connections.

§ 3.4.2 Except in the case of minor changes in the Work authorized by the Design Agent 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 Design Agent 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.

(Paragraph Deleted)

§ 3.5 WARRANTY

(Paragraph Deleted)

The Contractor warrants to the Owner and the Design Agent that materials and equipment furnished under the Contract will be of first quality, prime manufacture, 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, including substitutions not properly authorized, 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 Design Agent, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.6 TAXES

§ 3.6.1 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.

§ 3.6.2 The State of Rhode Island is exempt from payment of any federal or state excise, transportation, or sales tax. The Rhode Island Department of Administration Division of Purchases will furnish Exemption Certificates upon request.

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§ 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 required by the Rhode Island State Building Code 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. The Contractor shall be responsible for obtaining the Certificate of Occupancy from the appropriate governmental authorities.

§ 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 The Contractor shall promptly notify the Design Agent and the Owner if the Contractor becomes aware that the Contract Documents are not in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities. 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 Design Agent before conditions are disturbed and in no event later than 21 working days after first observance of the conditions. The Design Agent will promptly investigate such conditions and, if the Design Agent 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 Design Agent 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 Design Agent shall promptly notify the Owner and Contractor in writing, stating the reasons. If either party disputes the Design Agent'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 Design Agent. 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.

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§ 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 Design Agent the name and qualifications of a proposed superintendent. The Design Agent may reply within 14 working days to the Contractor in writing stating (1) whether the Owner or the Design Agent has reasonable objection to the proposed superintendent or (2) that the Design Agent requires additional time to review. Failure of the Design Agent to reply within the 14 working-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 Design Agent 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, within 20 working days after the issuance of the Purchase Order, shall prepare and submit for the Owner's and Design Agent'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, not less frequently than monthly, 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. The Contractor shall certify on the initial schedule and all revised schedules that they comply with the Contract Documents.

§ 3.10.2 The Contractor shall prepare a submittal schedule, within 20 working days after the issuance of the Purchase Order, and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Owner's and the Design Agent's approval. The Owner's and the Design Agent'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 Owner and the Design Agent 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 Design Agent.

§ 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 Design Agent and shall be delivered to the Design Agent 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

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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 Design Agent is subject to the limitations of Section 4.2.7. Informational submittals upon which the Design Agent 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 Design Agent without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Design Agent Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the submittal schedule approved by the Owner and the Design Agent 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 Design Agent 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 Design Agent.

§ 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 Design Agent's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Design Agent in writing of such deviation at the time of submittal and (1) the Design Agent 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 Design Agent'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 Design Agent on previous submittals. In the absence of such written notice, the Design Agent'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 Design Agent 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 Design Agent. The Owner and the Design Agent 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 Design Agent have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Design Agent 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.

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§ 3.12.11 The Owner shall be entitled to reimbursement from the Contractor for amounts paid to the Design Agent for evaluation of resubmittals.

§ 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 any restrictions imposed by the User Agency or the Owner, 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 Design Agent 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 Design Agent 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 Design Agent. 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 Design Agent and the Owner.

§ 3.18 INDEMNIFICATION

§ 3.18.1 To the fullest extent permitted by law the Contractor shall indemnify and hold harmless the Owner, the State of Rhode Island, its elected and appointed officials, members, employees, and agents, the Design Agent, the Design Agent's Consultants, Subconsultants, and Subcontractors, and agents and employees and any of them from and against any and all claims, demands, damages, liabilities, judgments, losses and expenses, including but not limited to reasonable attorneys' fees and costs of mediation, arbitration, and/or litigation, arising out of or resulting from performance of the Work, and/or the obligations of the under the Contract Documents, but only to the extent caused by willful misconduct and/or 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 any such claim, demand, damage, liability, judgment, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor,

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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.

§ 3.18.3 Without limiting the generality of the foregoing, the defense and indemnity set forth in this Section 3.18 includes, without limitation, all liabilities, damages, losses, claims, demands, and actions on account of bodily injury, death, or property loss to a person or entity indemnified hereunder or any other persons or entities, whether based upon statutory (including, without limitation, workers compensation), contractual, tort, or other liability of any person or entity so indemnified.

§ 3.18.4 The remedies set forth herein shall not deprive any person indemnified hereunder of any other indemnity action, right, or remedy otherwise available to any such person or entity at common law or otherwise.

§ 3.18.5 The Contractor will include the indemnity set forth in this Section 3.18, without modification, in each Subcontract with any Subcontractor.

§ 3.18.6 Notwithstanding any other language in the Contract Documents to the contrary, the indemnity hereunder shall survive Final Completion of the Work and final payment under the Agreement and shall survive any termination of the Agreement.

ARTICLE 4 DESIGN AGENT

§ 4.1 GENERAL

§ 4.1.1 The Design Agent is the person lawfully licensed to practice his or her profession in the State of Rhode Island or an entity lawfully practicing its profession in the State of Rhode Island and identified in the Contract Documents as the Design Agent. The term "Design Agent" means the Design Agent or the Design Agent's authorized representative.

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

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

§ 4.2 ADMINISTRATION OF THE CONTRACT

§ 4.2.1 The Owner with assistance from the Design Agent will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction through the date the Design Agent issues the final Certificate for Payment and continuing until the expiration of the one-year period following Final Completion. The Design Agent will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Design Agent 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 Design Agent will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Design Agent 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 Owner is entitled to reimbursement from the Contractor for amounts paid to the Design Agent for site visits made necessary by the fault of the Contractor or by defects and deficiencies in the
(Paragraph Deleted)

Work.

§ 4.2.3 On the basis of the site visits, the Design Agent 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

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Documents and from the most recent construction schedule submitted by the Contractor, and (2) defects and deficiencies observed in the Work. The Design Agent will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Design Agent 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 Design Agent about matters arising out of or relating to the Contract. Communications by and with the Design Agent's consultants shall be through the Design Agent. 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 Design Agent's evaluations of the Contractor's Applications for Payment, the Design Agent will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Design Agent has authority to reject Work that does not conform to the Contract Documents. Whenever the Design Agent considers it necessary or advisable, the Design Agent 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 Design Agent 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 Design Agent 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 Design Agent 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 Design Agent's action will be taken in accordance with the submittal schedule approved by the Design Agent or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Design Agent'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 Design Agent'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 Design Agent's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Design Agent, of any construction means, methods, techniques, sequences or procedures. The Design Agent's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

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

§ 4.2.9 The Design Agent 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 Design Agent agree, the Design Agent will provide one or more project representatives to assist in carrying out the Design Agent'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 Design Agent will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Design Agent's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

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§ 4.2.12 Interpretations and decisions of the Design Agent 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 Design Agent 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 Design Agent's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents and approved by the Owner.

§ 4.2.14 The Design Agent will review and respond to requests for information about the Contract Documents. The Design Agent's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Design Agent 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 and the Design Agent the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each portion of the Work. The Owner may reply within 14 working days to the Contractor in writing stating (1) whether the Owner or the Design Agent has reasonable objection to any such proposed person or entity or (2) that the Owner or Design Agent requires additional time for review.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Design Agent 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 Design Agent has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Design Agent 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 Design Agent makes reasonable objection to such substitution.

§ 5.2.5 MANUFACTURERS AND FABRICATORS

§ 5.2.5.1 Not later than 10 working days after the date of commencement of the Work, the Contractor shall furnish in writing to the Owner and the Design Agent the names of the manufacturers or fabricators for certain products, equipment, and systems identified in the Specifications and, where applicable, the name of the installing Subcontractor. The Owner may reply within 14 working days to the Contractor in writing, stating: (i) whether the Owner or the Design Agent has reasonable objection to any such proposed person manufacturer or fabricator; or (ii) whether the Owner or Design Agent requires additional time to review.

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§ 5.2.5.2 The Contractor shall not contract with a proposed manufacturer, fabricator, or Subcontractor to whom the Owner or Design Agent has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.5.3 If the Owner or Design Agent has an objection to a manufacturer, fabricator, or Subcontractor proposed by the Contractor, the Contractor shall propose another to whom the Owner or Design Agent has no objection.

§ 5.2.5.4 The Contractor shall not substitute a manufacturer, fabricator, or Subcontractor previously selected if the Owner or Design Agent makes reasonable objection to such substitution.

§ 5.3 SUBCONTRACTUAL RELATIONS

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Design Agent. Upon the request of the User Agency and/or the Owner, the Contractor shall provide the User Agency and/or the Owner with copies of each subcontract agreement. Each subcontract agreement shall preserve and protect the rights of the Owner and Design Agent 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.

(Paragraph Deleted)

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 working 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.

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.

§ 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

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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 Design Agent 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 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 between the Owner and the Contractor; a Construction Change Directive requires agreement by the Owner 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 Design Agent 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 Contractor and signed by the Owner, Contractor and Design Agent stating their agreement upon all of the following:

.1 The change in the Work;

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

§ 7.2.2 Subsequent to the approval of a Change Order as provided in § 7.1.2, whether such Change Order changes the Contract Sum or Contract Time or both, no additional claim related to such Change Order will be considered by the Owner. Any change, once incorporated into a Change Order, is all inclusive, and includes all factors that could have been considered at the time of the Change Order such as Project impact or schedule "ripple" effect.

§ 7.3 CONSTRUCTION CHANGE DIRECTIVES

§ 7.3.1 A Construction Change Directive is a written order prepared by the Design Agent and signed by the Owner, 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 Deleted.

§ 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 Design Agent 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 Design Agent 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 Section 7.3.1. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Design Agent 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 delivery;
.3 Rental costs of machinery and equipment, exclusive of hand tools; or
.4 Costs of premiums for all bonds and insurance and permit fees related to the Work..

(Paragraph Deleted)

§ 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 Design Agent. 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.

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§ 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 Design Agent will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Design Agent determines, in the Design Agent's professional judgment, to be reasonably justified. The Design Agent'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 Design Agent 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 Contractor will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.3.11 The combined overhead and profit included in the total cost to the Owner for a change in the Work shall be based on the following schedule:

.1 For the Contractor, for work performed by the Contractor's own forces, an amount not to exceed ten (10%) percent of the cost.

.2 For the Contractor, for work performed by the Contractor's Subcontractors, an amount not to exceed five (5%) of the amount due to the Subcontractors.

.3 For each Subcontractor, for work performed by the Subcontractor's own forces, an amount not to exceed ten (10%) percent of the cost.

.4 Where the Work represents both additions and deletions and results in a net increase, the allowable overhead and profit shall be in accordance with this Section 7.3.11, but in no event shall the amount exceed fifteen (15%) percent of the net increase in the cost of the Work.

§ 7.3.12 All proposals with an aggregate cost equal to or in excess of $500.00 shall be accompanied by a detailed itemization of costs, including labor, materials (quantities and prices), and Subcontracts, in a form acceptable to the Owner. In no event will a change order request reflecting an aggregate cost equal to or in excess of $500.00 be approved without such
(Paragraph Deleted)

itemization.

§ 7.4 MINOR CHANGES IN THE WORK

The Design Agent with the prior written approval of the Owner 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 affected by written order signed by the Design Agent 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.

The date of commencement of the Work is the date established in Section 3.1 of the Agreement..

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

§ 8.1.4 Deleted.

§ 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 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

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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 Design Agent, 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, then the Contract Time shall be extended by Change Order for such reasonable time as the Owner 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

Within 20 working days of the issuance of the Purchase Order, and promptly if revision is necessary from time to time as a result of a Change Order, the Contractor shall submit to the Owner, 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 Design Agent and the Owner may require. This schedule, if and when approved by the Design Agent and the Owner in writing, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 9.3 APPLICATIONS FOR PAYMENT

§ 9.3.1 At least 10 working days before the date established for each progress payment, the Contractor shall submit to the Design Agent and the Owner for approval an itemized Application for Payment prepared in accordance with the schedule of values 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 the Design Agent 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 All Applications for Payment for Change Orders must be accompanied by a Notice of Change in Purchase Order issued by the Owner, and if directed by the Owner, by the User Agency.

§ 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.

§ 9.3.1.3 The form of Application for Payment shall be AIA Document G702, Application and Certification for Payment, supported by AIA Document G702A, Continuation Sheet.

§ 9.3.1.4 Until Substantial Completion, the Owner shall pay ninety-five (95%) percent of the amount due the Contract on account of progress payments.

§ 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

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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 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. The Contractor shall immediately satisfy any lien, claim, or encumbrance against the site where the Project is located and indemnify the Owner from and against all resulting costs and expenses, including without limitation, attorneys' fees.

§ 9.4 CERTIFICATES FOR PAYMENT

§ 9.4.1 The Design Agent will, within 7 working 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 Design Agent determines is properly due, or notify the Contractor and Owner in writing of the Design Agent'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 Design Agent to the Owner, based on the Design Agent's evaluation of the Work and the data comprising the Application for Payment, that, 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 Design Agent. 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 Design Agent 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.

§ 9.4.3 The Contractor must submit all product literature, material and color samples with each Application for Payment, or as otherwise required by the Owner.

§ 9.5 DECISIONS TO WITHHOLD CERTIFICATION

§ 9.5.1 The Design Agent will withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Design Agent's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Design Agent is unable to certify payment in the amount of the Application, the Design Agent will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Design Agent cannot agree on a revised amount, the Design Agent will promptly issue a Certificate for Payment for the amount for which the Design Agent is able to make such representations to the Owner. The Design Agent 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 Design Agent'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;
.7 failure to carry out the Work in accordance with the Contract Documents; or
.8 any other failure to comply with the obligations of the Contractor under the Contract Documents.

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

§ 9.5.3 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 Design Agent and the Design Agent will reflect such payment on the next Certificate for Payment.

§ 9.6 PROGRESS PAYMENTS

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

§ 9.6.2 The Contractor shall pay each Subcontractor no later than 10 working 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 Design Agent 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 Design Agent 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 7 working days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. The Owner shall have the right to withhold payment(s) to the Contractor in the event that any Subcontractors or material and equipment suppliers have not been properly paid. Neither the Owner nor Design Agent 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 Design Agent does not issue a Certificate for Payment, through no fault of the Contractor, within 7 working days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within 7 working days after the date established in the Contract Documents the amount certified by the Design Agent or awarded by binding dispute resolution, then the Contractor may, upon 7 additional working days' written notice to the Owner and Design Agent, make a claim for payment as provided under the provisions of applicable law.
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§ 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.

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§ 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 Design Agent 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 Design Agent will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Design Agent'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 Design Agent. In such case, the Contractor shall then submit a request for another inspection by the Design Agent to determine Substantial Completion. The Design Agent will perform no more than 2 inspections to determine whether the Work or a designated portion thereof has attained Substantial Completion in accordance with the Contract Documents. The Owner is entitled to reimbursement from the Contractor for amounts paid to the Design Agent for any additional inspections.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Design Agent 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.

§ 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 lessthe amount of five (5%) percent to be retained by the Owner in accordance with R.I. Gen. Laws § 37-12-10.1. 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 Design Agent 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 Design Agent.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor and Design Agent 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 Design Agent will promptly make such inspection and, when the Design Agent finds the Work acceptable under the Contract Documents and the Contract fully performed, the Design Agent will promptly issue a final Certificate for Payment stating that to the best of the Design Agent's knowledge, information and belief, and on the basis of the Design Agent'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 Design Agent's final

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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. The Design Agent will perform no more than 2 inspections to determine whether the Work or a designated portion thereof has attained Final Completion in accordance with the Contract Documents. The Owner is entitled to reimbursement from the Contractor for amounts paid to the Design Agent for any additional inspections.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Design Agent (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 working days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner, and (6) all other close-out documents required by the Owner, including without limitation, all as-built plans, warranties, manuals, and other materials set forth in the Contract Documents. 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 Design Agent so confirms, the Owner shall, upon application by the Contractor and certification by the Design Agent, 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 Design Agent 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;
- **.3** terms of special warranties required by the Contract Documents; or
- **.4** claims permitted under the State of Rhode Island General Conditions of Purchase Regulation.

§ 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.

§ 9.11 The Contractor and the Contractor's surety shall be liable for and shall pay the Owner as liquidated damages the sums specified in the Solicitation and Bid Form, or if completed, the amount set forth in Section 3.4 of the Agreement.

§ 9.12 Warranties required by the Contract Documents shall commence on the date of Final Completion of the Work.

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

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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 and in consultation with the appropriate governmental authorities.

§ 10.2.4.1 When use or storage of explosives, or other hazardous materials, substances or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall give the User Agency and the Owner reasonable advance notice.

§ 10.2.4.2 If the Contract Documents require the Contractor to handle materials or substances that under certain circumstances may be designated as hazardous, the Contractor shall handle such materials in an appropriate manner.

§ 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 Design Agent 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 Design Agent.

§ 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. 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 Design Agent in writing.

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§ 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 Design Agent 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 Design Agent 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 Design Agent has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Design Agent 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 extent permitted by the provisions of R.I. Gen. Laws §§ 9-31-1 et seq., the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Design Agent, Design Agent'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 is specified in the Solicitation and 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;

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.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.

§ 11.1.1.2 The Contractor's liability insurance shall include all major coverages and be on a comprehensive general liability basis.

§ 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 as specified in the Solicitation and as otherwise acceptable to the Owner shall be filed with the Owner and the User Agency 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 working days' prior written notice has been given to the Owner and the User Agency. 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 User Agency, and their elected and appointed officials, members, employees, and agents, the Design Agent and the Design Agent's consultants as additional insureds for claims caused in whole or in part by the Contractor's acts or omissions during the Contractor's operations; and (2) the Owner, the User Agency, and their elected and appointed officials, members, employees, and agents, as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

§ 11.1.5 The Contractor shall be responsible for the prompt payment to the Owner of any deductible amounts under any insurance policies required under the Contract Documents for claims made pursuant to such policies.

§ 11.2 OWNER'S LIABILITY INSURANCE.

§ 11.2.1 The Contractor shall furnish the Owner and the User Agency, through the Design Agent, an insurance certificate providing Owner's Protective Liability extended to include the interests of the Design Agent, and to protect the Owner, User Agency, and Design Agent from any liability which might be incurred against any of them as a result of any operation of the Contractor or Subcontractors or their employees or anyone for whom either the Contractor or Subcontractors are responsible. Such insurance shall be written for the same limits as the Contractor's commercial general liability insurance and shall include the same coverage.

§ 11.2.2 If the Owner engages separate contractors to perform work for, or in or around, the Project, it shall require in its contracts with each separate contractor that Contractor and its officers, directors, partners, members, employees, and agents shall be: (i) named as additional insureds on a primary, noncontributory basis to any commercial general liability, pollution liability, and excess liability insurance policies; and (ii) provided a waiver of subrogation on all workers compensation and professional liability insurance policies.

§ 11.3 PROPERTY INSURANCE

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§ 11.3.1 The Contractor shall purchase and maintain, in a company or companies lawfully authorized to do business in the state of Rhode Island, 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 User Agency, the Contractor, Subcontractors and Sub-subcontractors in the Project. If the Owner and/or the User Agency incur any damages by failure of the Contractor to maintain such insurance, then the Contractor shall bear all reasonable cost resulting from such failure.

§ 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 Design Agent's and Contractor's services and expenses required as a result of such insured loss.

§ 11.3.1.2 Deleted.

§ 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 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 Deleted.

(Paragraph Deleted)

§ 11.3.3 Deleted.

(Paragraph Deleted)

§ 11.3.4 Deleted.

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

§ 11.3.7 WAIVERS OF SUBROGATION

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The Contractor waives all rights against the Owner and the User Agency and any of their subcontractors, sub-subcontractors, agents and employees, and (2) the Design Agent, Design Agent'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 Design Agent, Design Agent'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 this property insurance shall be adjusted by the Contractor 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 Contractor's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Contractor shall deposit in a separate account proceeds so received, which the Contractor shall distribute in accordance with such agreement as the parties in interest may reach, 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 Contractor as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within 5 working days after occurrence of loss to the Contractor's exercise of this power; if such objection is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution in the Agreement.

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

§ 11.4.1 The Contractor shall furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in the Solicitation.

§ 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 Design Agent's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Design Agent, be uncovered for the Design Agent'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 Design Agent has not specifically requested to examine prior to its being covered, the Design Agent 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

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The Contractor shall promptly correct Work rejected by the Design Agent 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 Design Agent'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 Final 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. If the Contractor fails to correct nonconforming Work within a reasonable time after receipt of notice from the Owner or Design Agent, 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.

§ 12.2.2.4 Upon request by the Owner and prior to the expiration of one year from the date of Final Completion, the Design Agent will conduct and the Contractor shall attend 2 meetings with the Owner to review the facility operations and performance.

§ 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 State of Rhode Island.

§ 13.2 SUCCESSORS AND ASSIGNS

§ 13.2.1 The Owner and Contractor respectively bind themselves, their 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.

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§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to any executive, legislative, judicial, regulatory, or administrative body of the state, or any political subdivision thereof, including without limitation, any department, division, agency, commission, board, office, bureau, authority, school, water, or fire district, or other agency of Rhode Island state or local government that exercises governmental functions, any other governmental authority, and any quasi-public corporation and/or body corporate and politic. 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, or when received, if manually delivered or transmitted by electronic mail or facsimile to the last such 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, Design Agent 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 Design Agent timely notice of when and where tests and inspections are to be made so that the Design Agent 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 Design Agent, 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 Design Agent 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 Design Agent of when and where tests and inspections are to be made so that the Design Agent 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 Design Agent'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 Design Agent.

§ 13.5.5 If the Design Agent is to observe tests, inspections or approvals required by the Contract Documents, the Design Agent 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

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No interest shall be due or payable on account of any payment due or unpaid under the Contract Documents except in accordance with the provisions of "Prompt Payment by Department of Administration," R.I. Gen. Laws §§ 42-11.1-1 et seq.

§ 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. 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 calendar 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; or
.3 Because the Design Agent 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

(Paragraph Deleted)

§ 14.1.2 Deleted.

§ 14.1.3 If one of the reasons described in Section 14.1.1 exists, the Contractor may, upon 7 working days' written notice to the Owner and Design Agent, terminate the Contract and recover from the Owner payment for Work executed.

§ 14.1.4 If the Work is stopped for a period of 60 calendar 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 7 additional days' written notice to the Owner and the Design Agent, 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 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 disregards or fails to comply with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority;
.4 otherwise is guilty of breach of a provision of the Contract Documents; or
.5 cancels or the Contractor or the Owner receives notice of cancellation or nonrenewal of any insurance required under 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, 7 working 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

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.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 Design Agent'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 Owner shall not be liable to the Contractor or any Subcontractor for claims or damages of any nature caused by or arising out of any delays. The sole remedy against the Owner for delays shall be the allowance of additional time for completion of the Work in accordance with the provisions of Section 8.3.1.

§ 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.

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. Such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly serviced if delivered in person, by mail, by courier, or by electronic transmission. Claims by either party must be initiated within 21 working days after occurrence of the event giving rise to such Claim or within 21 working 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 Design Agent will prepare Change Orders and issue

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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.

§ 15.1.5.3 Claims for increase in the Contract Time shall set forth in detail the circumstances that form the basis for the Claim, the date upon which each cause of delay began to affect the progress of the Work, the date upon which each cause of delay ceased to affect the progress of the Work and the number of days' increase in the Contract Time claimed as a consequence of each such cause of delay. The Contractor shall provide such supporting documentation as the Owner may require including, where appropriate, a revised construction schedule indicating all the activities affected by the circumstances forming the basis of the Claim.

§ 15.1.5.4 The Contractor shall not be entitled to a separate increase in the Contract Time for each one of the number of causes of delay which may have concurrent or interrelated effects on the progress of the Work, or for concurrent delays due to the fault of the Contractor.

§ 15.1.6
The Contractor waives Claims against the Owner for consequential damages arising out of or relating to this Contract. This waiver includes
(Paragraph Deleted)

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.
This waiver is applicable, without limitation, to all consequential damages due to the Contractor's termination in accordance with Article 14. Nothing 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 shall be referred to the Initial Decision Maker for initial decision. The Purchasing Agent appointed pursuant to the provisions of the "State Purchases Act," R.I. Gen. Laws § 37-2-1 et seq., will serve as the Initial Decision Maker in accordance with the provisions of the State Purchases Act, State of Rhode Island Procurement Regulations, and this Section 15.2.1. An initial decision shall be required as a condition precedent to binding dispute resolution pursuant to Section 15.3.1 of any Claim arising prior to the date final payment is due.

§ 15.2.2 Deleted.

§ 15.2.3 Deleted.

§ 15.2.4 Deleted.

§ 15.2.5 Deleted.

§ 15.2.6 Deleted.

§ 15.2.6.1 Deleted.

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§ 15.2.7 Deleted.

§ 15.2.8 Deleted.

§ 15.3 MEDIATION

§ 15.3.1 For any Claim not resolved by the Initial Decision Maker procedures set forth in Section 15.2.1, and prior to the implementation of the binding dispute resolution procedures set forth in Section 15.4.1, the Contractor or the Design Agent shall have the option to pursue mediation,
exercisable by written notice to the
Owner within 30 calendar days of an Initial Decision. In the event of the exercise of such option by the Contractor or the
Design Agent, the Owner and the Contractor or the Design Agent shall attempt to select a mediator, and in the event that the Owner and the
Contractor or the Design Agent cannot agree on a mediator, either party may apply in writing to the
(Paragraph Deleted)

Presiding Justice of the Providence County Superior Court, with a copy to
the other, with a request for the court to appoint a mediator, and the costs of the mediator shall be borne equally by both parties.

§ 15.3.2 Deleted.

§ 15.3.3 Deleted.

§ 15.4 BINDING DISPUTE RESOLUTION

§ 15.4.1 For any Claim not resolved by the Initial Decision Maker procedures set forth in Section 15.2.1, or mediation at the option of the Contractor pursuant to Section 15.3.1, the method of binding dispute resolution shall be determined in accordance with the provisions of the "Public Works Arbitration Act," R.I. Gen. Laws §§ 37-16-1 et seq.

§ 15.4.4 Deleted.

§ 15.4.4.1 Deleted.

§ 15.4.4.2 Deleted.

§ 15.4.4.3 Deleted.

§ 16 COMPLIANCE WITH APPLICABLE LAW

The Contractor and its Subcontractors shall comply with all applicable federal, state, and local laws.

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DOCUMENT 00 73 46
WAGE DETERMINATION SCHEDULE

The State of Rhode Island Department of Labor, Division of Professional Regulation General Decision Modification document, in effect at the time of the Bid issuance for this Project, is an integral part of the Bid Documents for use in fulfilling prevailing wage rate requirements. A copy is available on the web site of the State of Rhode Island Department of Administration, Division of Purchases.

The Division of Purchases Web Site Address:

http://www.purchasing.state.ri.us/home.html

Click on “Information”; click on “Prevailing Wage Table”.

Documents are not contained within this Project Manual, may be obtained from the State of Rhode Island, Department of Labor and Training, Division of Professional Regulations, 1511 Pontiac Avenue, Cranston, RI 02920-4407, Tel. No. 401-462-8580.

END OF DOCUMENT 00 73 46

CCRI CHILLER REPLACEMENT
Newport Campus
Newport, Rhode Island 02840 AA# 19052

DOCUMENT 00 91 13
ADDENDA

PART 1 GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

A. As of the time of publication of this project manual no addenda had been issued.

B. Should Addenda be issued during the Bid Period, They will augment this Document and become a part of the Project Manual.

C. Such Addenda and Modifications when issued, with reference to the Project Manual, the General Conditions, Supplemental General Conditions, Drawings or Specifications, shall be inserted following this page and become integral parts of the Contract Documents.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTIONS (Not Applicable)

END OF SECTION 00 91 13

CCRI CHILLER REPLACEMENT
Newport Campus
Newport, Rhode Island 02840 AA# 19160

SECTION 01 10 00
SUMMARY OF WORK

PART 1 GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

A. The Project consists of replacement of the primarily direct fired absorption chiller-heater at the Community College of Rhode Island's Newport Campus and replace with modular units as indicated in the Contract Documents. Replacement of door hardware at Library including addition of automatic operators.

B. Coordination with Owner's separate concurrent contracts, if any.

C. General Requirements:

1. The existing chiller/heat absorption unit must remain active during the Project. It is the only source of heat and cooling for the building.

2. Contractor shall perform the Work of the Contract under a stipulated sum Contract with the Owner in accordance with the Conditions of Contract.

3. All bidders are to include the number of hours that the work will be accomplished during the third shift and on weekends below which is included in the Bid Form. The College will deduct the identified rate based on the third shift and weekend hours from the Contractors invoice as required. This cost is to be included in your Base Bid Price. Any unused money is retained by the Contractor. If more hours than identified are used, the College will take the appropriate money based on the hours worked third shift and on weekends.

The Base Bid Price ***includes*** the cost of one CCRI College Police Officer to be present during all third shift and weekend construction. The cost will be $45 per hour multiplied by the number of on-site work days, which equals the amount to be entered below:

$45 per Hour X _____ Hours = $_____

4. Vendor is responsible for obtaining and paying for any required Local and State licenses, Permits and Inspections.

5. Contractor to include all Bond costs in their Bid.

6. Before starting work, all Contractor workers and Subs are required to obtain and submit a current BCI and State-approved picture ID. CCRI reserves the right to deny Campus access to any worker based on information provided on the submitted BCI. All BCI's to be current within one calendar month. BCI'S are required from the State of Residence and RI if an out of state worker.

7. All onsite workers are to be OSHA 10 certified. Copies of certifications along with driver licenses are required on the first day of work.

8. The Contractor is responsible for providing their workers with all personal protection equipment. at a minimum, this includes hard hats, reflective vests, eye protection, harnesses and ear protection.

9. All completed work must be inspected and approved by College and Architect.

10. There will be mandatory bi- weekly progress meetings onsite with four week look a-head schedules to be furnished to the architect and College.

11. Vendor and/or its subcontractors are to be licensed as required by RI Department of Labor.

10. All contractors and subcontractors to sign in each employee at the CCRI Security Office located on the lower level at the start of each shift.

11. A full time superintendant is required for the extent of construction. Selected vendor to submit resume of proposed Superintendant and/or on site personnel for College team to review and approve. College reserves the right to reject proposed Superintendant.

12. A full list of subcontractors to be provided as part of the submittal package at the time of tentative award.

13. No substitution will be considered prior to receipt of bid unless written request for approval has been received by the Division of Purchases no later than 10 days before the closing of the Bid. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data and other information necessary for any evaluation. A statement setting forth changes in other materials, equipment, or other portions of the work, including changes in work of other contracts that incorporation of the proposed substitution would require, shall be included. The burden of proof of the merit of the proposed substitution is upon the proposer. The State of Rhode Island's decision of approval or disapproval of the proposed substitution shall be final. If the State approves a proposed substitution prior to receipt of bids, such approval will be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner. No substitutions will be considered after the Contract Award except as provided for in the contract documents.

14. Contractors are not permitted to display a project sign anywhere on the campus grounds.

15. Contractor to provide all conex boxes for storing of their equipment of tools. The College is not responsible for lost or stolen tools/equipment or materials. Placement & Quantity of Conex Boxes shall be coordinated with and approved by the College.

1.02 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.

1.03 FUTURE WORK

A. FUTURE CONTRACT: The Owner reserves the right to award contracts for additional work to be performed at the site during construction and following the Substantial Completion. Completion of that future work depends on the progress of, and the successful and timely completion of, the preparatory and related Work of this Contract.

1.04 CONTRACTOR USE OF SITE AND PREMISES

A. GENERAL: The Owner intends to fully occupy the facility during the period of construction.

B. CONSTRUCTION OPERATIONS: Coordinate with Owner to insure delivery and completion per the schedule. Include all costs of this coordination, including all premium time wages that may be required

to meet these requirements, in the Base bid. Fulltime maintenance and security personnel are on staff at CCRI during night and weekend hours. The College is not responsible for stolen materials, tools, equipment, etc.

C. Provide access to and from site as required by law and by Owner:

1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if routes are temporarily altered during 3rd shift only. Include and maintain temporary fire extinguishers within the limit of construction.

2. Do not obstruct roadways, sidewalks or other public ways without permission from the Owner.

3. Contractor to provide temporary signage to identify the work area and emergency egress points.

D. TIME RESTRICTIONS

1. No weekend work will be permitted.

2. All Work is to be performed during first shift with the exception of the demolition and any noisy work such as drilling into the concrete or disruptive work shall occur third shift between the hours of 10:00PM to 6:00AM to avoid disruptions of Campus and classes.

3. Coordinate work with college staff to avoid disruptions of college activities. Coordinate and adjust workflow weekly and by special request.

E. UTILITY OUTAGES AND SHUTDOWN

1. Do not disrupt or shut down life safety systems, including but not limited to fire alarm system, without 7 days notice to the Owner and authorities having jurisdiction.

2. Prevent accidental disruption of utility services to other facilities. Any and all shutdowns to occur during third shift.

3. Do not disrupt building control wiring or fire alarm wiring passing through the area of work.

F. Protect all existing surfaces from damages. Any damages to the existing surfaces requiring replacement and or repair shall be at Contractor's expense.

G. Construction areas shall be kept in a clean, safe and acceptable condition on a daily basis at all times and at completion of the Project.

H. Contractor is responsible for removing all debris off the site daily, including all costs associated with waste containers and proper disposal of waste.

I. Vendor is to have all equipment necessary to perform the installation and service including, tools, staging, lift truck, etc. No CCRI equipment or tools will be available.

J. A Conex box is allowed for storage on site. Location to be determined.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTIONS (Not Applicable)

END OF SECTION 01 11 00

CCRI CHILLER REPLACEMENT
Newport Campus
Newport, Rhode Island 02840 AA# 19160

SECTION 01 29 00
PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Schedule of Values.

B. Change procedures.

C. Procedures for preparation and submittal of Applications For Payment.

D. Defect Assessment.

E. Sales Tax Exemption.

F. Warranty Inspection Retainage.

1.02 RELATED SECTIONS

A. Document 00 72 00 - General Conditions: Progress Payments and Final Payment.

B. Section 01 33 00 – Submittal Procedures.

C. Section 01 78 00 – Closeout Procedures and Submittals.

1.03 SCHEDULE OF VALUES

A. Submit typed schedule on AIA Form G703 - Application and Certificate for Payment Continuation Sheet. Contractor's standard form or electronic media printout will be considered.

B. Submit Schedule of Values in duplicate within 15 days after date of receipt of a Purchase Order from the State Division of Purchases.

C. FORMAT: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the major specification Section. Identify site mobilization, bonds and insurance and General Conditions.

D. Include in each line item, the amount of Allowances specified in this Section. For Unit Cost Allowances, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.

E. Include within each line item, a directly proportional amount of Contractor's overhead and profit.

F. Revise schedule to list approved Change Orders, with each Application For Payment.

1.04 CHANGE PROCEDURES

A. The Architect will advise of minor changes in the Work not involving an adjustment to Contract Sum/Price or Contract Time by issuing supplemental instructions on AIA Form G710 Architect's Supplemental Instructions or other similar form.

B. The Architect may issue a Proposal Request which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change. Contractor will prepare and submit an estimate within 7 days.

C. The Contractor may propose a change by submitting request for change to the Architect, describing the proposed change and its full effect on the Work. Include a statement describing the reason for the change, and the effect on the Contract Sum/Price and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 01 60 00.

D. STIPULATED SUM/PRICE CHANGE ORDER: Based on Proposal Request and Contractor's fixed or maximum price quotation or Contractor's request for a Change Order as approved by Architect.

E. UNIT PRICE CHANGE ORDER: For pre-determined unit prices and quantities, the Change Order will be executed on a fixed unit price basis. For unit costs or quantities of units of work which are not pre-determined, execute Work under a Construction Change Authorization. Changes in Contract Sum/Price or Contract Time will be computed as specified for Time and Material Change Order.

F. TIME AND MATERIAL CHANGE ORDER: Submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract. Architect will determine the change allowable in Contract Sum/Price and Contract Time as provided in the Contract Documents.

G. CONSTRCTION CHANGE MARK-UP: See AIA Documents.

H. CONSTRUCTION CHANGE AUTHORIZATION: Architect may issue a directive, on AIA Form G713 Construction Change Authorization or similar form, signed by the Owner, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work, and designate method of determining any change in Contract Sum/Price or Contract Time. Promptly execute the change.

I. Maintain detailed records of work done on Time and Material basis. Provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the Work.

J. CHANGE ORDER FORMS: AIA G701 Change Order.

K. EXECUTION OF CHANGE ORDERS: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

L. CORRELATION OF CONTRACTOR SUBMITTALS

1. Promptly revise the Schedule of Values and the Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

2. Promptly revise Progress Schedules to reflect any change in Contract Time. Revise sub-schedules to adjust times for any other items of Work affected by the change and resubmit.

3. Promptly enter changes in the Project Record Documents.

1.05 ADMINISTRATIVE SUBMITTALS

A. APPLICATION FOR PAYMENT: In accordance with the General Conditions and as specified herein.

B. FINAL APPLICATION FOR PAYMENT: As specified herein.

1.06 SUBMITTAL PROCEDURES

A. Submit three copies of each Application for Payment.

B. Submit an updated construction schedule with each Application for Payment.

C. PAYMENT PERIOD: Submit at intervals stipulated in the Agreement.

D. Submit under transmittal letter specified in Section 01 33 00.

E. Submit lien waivers.

1.06 FORMAT

A. AIA G702 - Application and Certificate for Payment, including continuation sheets when required.

B. For each item, provide a column for listing: Item Number; Description of Work; Scheduled Value, Previous Applications: Work in Place and Stored Materials under this Application: Authorized Change Orders; Total Completed and Stored to Date of Application; Percentage of Completion; Balance to Finish; and Retainage.

C. Reference the General Conditions.

1.07 SUBSTANTIATING DATA

A. When Architect requires substantiating information, submit data justifying dollar amounts in question.

B. Provide one copy of data with cover letter for each copy of submittal. Show Application number and date, and line item by number and description.

1.08 PREPARATION OF APPLICATIONS

A. Present required information in typewritten form or on electronic media printout.

B. Execute certification by signature of authorized officer.

C. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored Products.

D. List each authorized Change Order as an extension on continuation sheet, listing Change Order number and dollar amount as for an original item of Work.

E. Prepare Application for Final Payment as specified in Section 01 77 99.

1.09 PAYMENT

A. GENERAL: Progress payment requests shall be submitted monthly as specified in the General Conditions.

B. Payment for Lump Sum Work covers all Work necessary to furnish, install and/or complete the Work of the Contract.

C. Payment for unit price items covers all Work necessary to furnish, install and/or complete the item.

D. Payment for equipment, materials and labor for items not included on the Bid shall be considered incidental and no separate payment will be made.

1.10 DEFECT ASSESSMENT

A. Replace the Work or portions of the Work not conforming to the specified requirements.

B. If, in the opinion of the Architect, it is not practical to remove and replace the Work, the Architect will direct an appropriate remedy or adjust payment.

1. The defective work may remain but the unit sum will be adjusted to a new sum at the discretion of the Architect.

2. The defective Work will be partially repaired to the instructions of the Architect and the unit sum will be adjusted to a new some sum at the discretion of the Architect.

3. The authority of the Architect to assess the defect and identify a payment adjustment is final.

C. Payment will not be made for following:

1. Loading, hauling, and disposing of rejected products.

2. Quantities of material wasted or disposed of in manner not acceptable.

3. Products determined as unacceptable before or after placement.

4. Material not completely unloaded from transporting vehicle.

5. Products remaining on hand after completion of the Work.

6. Material remaining on hand after completion of Work.

1.11 PARTIAL PAYMENT FOR STORED MATERIALS AND EQUIPMENT

A. FINAL PAYMENT: Will be made only for materials incorporated into the Work in the Contract; no partial payments shall be made for equipment or materials delivered to the site but not used.

1.12 FINAL APPLICATION FOR PAYMENT

A. Reference the General Conditions, and as may otherwise be required in the Contract Documents.

B. Prior to submitting final application, make acceptable delivery of required documents.

1.13 SALES TAX EXEMPTION

A. Owner is exempt for sales tax on products permanently incorporated in the Work of the Project.

1. Obtain Sales Tax Exemption Certificate number from Owner.

2. Place Exemption Certificate number on invoice for materials permanently incorporated in the Work of the Project.

3. Furnish copies of invoices to Owner.

4. Upon completion of Work, file a notarized statement with Owner that all purchases made under exemption certificate were entitled to be exempt.

5. Pay legally assessed penalties for improper use of Exemption Certificate number.

C. Prior to submitting final application, make acceptable delivery of required documents.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01 29 00

CCRI CHILLER REPLACEMENT
Newport Campus
Newport, Rhode Island 02840 AA# 19160

SECTION 01 30 00
ADMINISTRATIVE PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Site Administration.

B. Coordination and project conditions.

C. Pre-construction meeting.

D. Site mobilization meeting.

E. Progress meetings.

F. Pre-installation meetings.

1.02 SITE ADMINISTRATION

A. Maintain a Daily Attendance Log to include the names of all project employees and guests to the site. The log sheets must clearly indicate the Project Name, and the name of the General Contractor. Each line in the log should allow for the name of that employee, the employee's job title (use terminology used by prevailing wage job title), and the name of that employee's employer. Each guest signing the log should indicate a brief description of the reason for the visit and the guest's employer or organization.

1.03 COORDINATION AND PROJECT CONDITIONS

A. Coordinate the scheduling, submittals and the Work of the various Sections of the Project Manual to ensure an efficient and orderly sequence of the installation of interdependent construction elements.

B. Coordinate the scheduling, submittals and the Work of the various Sections of the Project Manual to ensure an efficient and orderly sequence of the installation of interdependent construction elements.

C. Coordinate the space requirements, supports and installation of the electrical Work. Utilize spaces efficiently to maximize accessibility for other installations, maintenance or repairs.

D. Coordinate the completion and clean up of the Work of the separate Sections in preparation for Substantial Completion.

1.04 PRE-CONSTRUCTION MEETING

A. The Contractor will schedule a meeting after a Purchase Order is issued to the Contractor by the CCRI Department of Purchasing.

B. ATTENDANCE REQUIRED: Owner, Architect and Contractor.

C. AGENDA:

A. Distribution of the Contract Documents.

B. Submission of a list of Subcontractors, a list of products, Schedule of Values and a Progress Schedule.

C. Designation of personnel representing the parties in the Contract, and the Architect.

D. The procedures and processing of field decisions, submittals, substitutions, Applications for Payment, Proposal Requests, Change Orders and Contract Closeout procedures.

E. Scheduling.

F. Contractor shall record the minutes and distribute copies within two days after the meeting to the participants, with two copies to the Architect, the Owner the participants and those affected by the decisions made.

1.05 SITE MOBILIZATION MEETING

The Contractor will schedule a meeting at the Project site prior to the Contractor's occupancy.

ATTENDANCE REQUIRED: Owner, Architect, Special Consultants, Contractor, Contractor's Superintendent and major Subcontractors.

AGENDA

1. Use of premises by the Owner and Contractor.

2. Owner's requirements and occupancy.

3. Security and housekeeping procedures.

4. Schedules.

5. Application for Payment procedures.

6. Contractor shall record the minutes and distribute copies within two days after the meeting to the participants, with two copies to the Architect, the Owner the participants and those affected by the decisions made.

1.06 PROGRESS MEETINGS

A. Architect shall schedule and administer the meetings throughout the progress of the Work at weekly or no more than monthly intervals.

B. Make arrangements for the meetings, prepare the agenda with copies for the participants and preside at the meetings.

C. ATTENDANCE REQUIRED: Contractor's Superintendent, major Subcontractors and suppliers, Owner and Architect as appropriate to the agenda topics at each meeting.

D. AGENDA

A. Review approval of minutes of previous meeting.

B. Review of Work progress since previous meeting.

C. Field observations, problems and decisions.

D. Problems that impede construction schedule.

E. Review of off-site fabrication, delivery schedules.

F. Maintenance of Progress Schedule.

G. Corrective measures and procedures to regain projected schedule.

H. Progress schedule during succeeding work period.

I. Maintenance of quality and Work standards.

J. Effect of proposed changes and substitutions on the Progress Schedule and coordination.

K. Coordination of schedules.

L. Other business.

M. Contractor shall record the minutes and distribute copies within two days after the meeting to the participants, with two copies to the Architect, the Owner the participants and those affected by the decisions made.

1.07 PRE-INSTALLATION MEETINGS

A. When required in the individual specification Sections, convene a pre-installation meeting at the site prior to commencing the Work of the Section.

B. Make arrangements for the meetings, prepare the agenda with copies for the participants and preside at the meetings.

C. Require attendance of the parties directly affecting, or affected by, the Work of the specific Section.

D. Prepare an agenda and preside at the meeting.

1. Review the conditions of the installation, preparation and installation procedures.

2. Review coordination with the related work.

3. Contractor to provide a mock-up installation at one of the Dental stations for review prior to installing all supports and arms.

4. Contractor shall record the minutes and distribute copies within two days after the meeting to the participants, with two copies to the Architect, the Owner the participants and those affected by the decisions made.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTIONS (Not Applicable)

END OF SECTION 01 30 00

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittal procedures.

B. Construction Progress Schedules.

C. Proposed Products List.

D. Product data and shop drawings.

E. Samples.

F. Design data.

G. Test Reports.

H. Certificates.

I. Manufacturer's instructions.

J. Manufacturer's field reports.

K. Architect's action.

1.02 RELATED DOCUMENTS

A. Drawings, General Provisions of the Contract and Division 1 Specification Sections apply to work of this Section.

1.03 SUBMITTAL PROCEDURES

A. MASTER LIST SUBMITTAL

1. Submit a Master List of the required submittals with a proposed date for each item to be submitted.

2. Show the date the submittal was sent, days since submittal was sent, status of submittal, date submittal was received in return and any date associated with re-submittals.

3. Update Master List with each submission and response.

B. GENERAL: Refer to the General Conditions for basic procedures for submittal handling.

C. SUBMITTAL PREPARATION: Mark each submittal with a permanent label for identification. Provide the following information on the label for proper processing and recording of action taken.

1. Project name; Date.

2. Name and address of Owner, Contractor and Supplier.

3. Name of manufacturer; Number and title of appropriate Specification Section; Drawing number and detail references, as appropriate; Similar definite information as necessary.

4. Provide a space on the label for the Contractor's review and approval markings, and a space for the Architect's "Action" marking.

D. SUBMITTAL TRANSMITTAL: Package each submittal appropriately for transmittal and handling. Transmit four (4) copies, plus the number of copies the Contractor wants returned to him after review of each submittal by the Architect, and to other destinations as required, by use of a transmittal form. Prepare a separate transmittal form for each division of work and identify each submittal by Specification Section number on the transmittal form. Submittals received from sources other than the Contractor will be returned to the sender "without action".

1. Submittals will be accepted via E-mail transmission.

2. Record relevant information and requests for data on the transmittal form. On the transmittal form, or on a separate sheet attached to the form, record deviations from the requirements of the Contract Documents, if any, including minor variations and limitations.

3. **No submittals will be accepted by the Architect if transmitted via FAX machine.**

4. Include the Contractor's signed certification stating that information submitted complies with requirements of the Contract Documents.

5. Sequentially number the transmittal forms; resubmittals to have original number with an alphabetic suffix.

E. CONTRACTOR'S REVIEW: Stamp of approval indicates to Owner and Architect that all quantities, dimensions, field construction criteria, materials, catalog numbers and similar data have been determined and verified, and that each submittal has been reviewed or coordinated with requirements of Work and Contract Documents. **Failure to provide the Contractor's Review Stamp shall be grounds for the Submittal to be returned to the Contractor with no action taken.**

F. No portion of Work requiring shop drawings shall be started or any materials be fabricated, delivered to site or installed prior to approval of such items. Fabrication performed, materials purchased or on-site construction accomplished which does not conform to approved shop drawings and data shall be at Contractor's risk. Owner will not be liable for any expense or delay due to corrections or remedies required to accomplish conformity.

G. Project work, materials, fabrications and installation shall conform to approved shop drawings.

H. COORDINATION: Coordinate the preparation and processing of submittals with the performance of the work. Coordinate each separate submittal with other submittals and related activities such as testing, purchasing, fabrication, delivery and similar activities that require sequential activity.

1. Coordinate the submittal of different units of interrelated work so that one submittal will not be delayed by the Architect's need to review a related submittal. The Architect reserves the right to withhold action on any submittal requiring coordination with other submittals until related submittals are forthcoming.

I. SCHEDULING: In each appropriate administrative submittal, such as the Progress Schedule, show the principal work-related submittals and time requirements for coordination of submittal activity with related work.

J. COORDINATION OF SUBMITTAL TIMES: Prepare and transmit each submittal to the Architect sufficiently in advance of the scheduled performance of related work and other applicable activities. Transmit different kinds of submittals for the same unit of work so that processing will not be delayed by the Architect's need to review submittals concurrently for coordination.

K. REVIEW TIME: Allow sufficient time so that the installation will not be delayed as a result of the time required to properly process submittals, including time for resubmittal, if necessary. Advise the Architect on each submittal, as to whether processing time is critical to the progress of the work, and if the work would be expedited if processing time could be shortened.

1. Allow Five (5) calendar days for the Architect's initial processing of each submittal, excluding delivery tome from and to the Contractor. Allow a longer time period where processing must be delayed for coordination with subsequent submittals. The Architect will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination.

2. Allow Two (2) calendar days for reprocessing each submittal.

3. No extension of time will be authorized because of the Contractor's failure to transmit submittals to the Architect sufficiently in advance of the work.

L. MISCELLANEOUS SUBMITTALS

1. INSPECTION AND TEST REPORTS: Classify each inspection and test report as being either "shop drawings" or "product data" depending on whether the report is specially prepared for the project, or a standard publication of workmanship control testing at the point of production. Process inspection and test reports accordingly.

2. SURVEY DATA: Provide copies of all survey data collected for property surveys, field measurements, and quantitative records of actual work, damage surveys and similar data required by the individual Sections of these specifications. None of the specified copies will be returned.

3. STANDARDS: Where submittal of a copy of standards is indicated, and except where copies of standards are specified as an integral part of a "Product Data" submittal, submit a single copy of standards for the Architect's use. Where workmanship, whether at the project site or elsewhere, is governed by a standard, furnish additional copies of the standard to installers, Owner's field representative and others involved in the performance of the Work.

4. CLOSEOUT SUBMITTALS: Refer to section "Project Closeout" and to individual Sections of these specifications for specific submittal requirements of project closeout information, materials, tools and similar items.

5. RECORD DOCUMENTS: Furnish set of original documents as maintained on the project site.

6. GENERAL DISTRIBUTION: Provide additional distribution of submittals to Subcontractors, suppliers, fabricators, installers, governing authorities and others as necessary for the proper performance of the Work. Include such additional copies of submittals in the transmittal to the Architect where the submittals are required to receive "Action" marking before final distribution. Record distributions on transmittal forms.

1.04 CONSTRUCTION PROGRESS SCHEDULES

A. Submit preliminary outline Schedules within 5 days after the receipt of a Purchase Order from CCRI Department of Purchasing for coordination with Owner's requirements. After being reviewed, submit detailed Schedules within 2 days modified to accommodate the revisions recommended by the Architect.

B. Show a complete sequence of construction by activity, identifying the Work of separate stages and other logically grouped activities. Indicate the early and late start, the early and late finish, float dates and duration. All work shall take place after school hours.

1.05 PRODUCT DATA AND SHOP DRAWINGS

A. Submit for review for the limited purpose of checking for conformance with the information given and the design concept expressed in the Contract Documents.

B. Submit the number of copies which the Contractor requires plus two copies the Architect will retain. For shop drawings, submit in the form of 4 opaque reproductions.

C. Should contractor choose to e-mail submittals, contractor will be responsible for copies to be filed for the owner upon completion of the project.

D. Mark each copy to identify the applicable products, models, options and other data. Supplement the manufacturer's standard data to provide information specific to this Project.

E. Indicate the product utility and electrical characteristics, utility connection requirements and the location of utility outlets for service for functional equipment and appliances.

F. After being reviewed, distribute in accordance with the requirements of this Section and provide copies for Record Documents described in Section 01 78 39.

1.06 SAMPLES

A. Submit for review for the limited purpose of checking for conformance with the information given and the design concept expressed in the Contract Documents.

B. Submit samples to illustrate the functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate the sample submittals for interfacing Work.

C. Include identification on each sample with full Project information.

D. Submit 2 samples of specified materials specified within the Construction Documents, in the individual specification Sections or as requested by the Architect. Architect will retain one sample.

E. Reviewed samples which may be used in the Work are indicated in the individual specification Sections.

F. Samples will not be used for testing purposes unless they are specifically stated to be in the individual specification Sections.

1.07 DESIGN DATA

A. Submit for the Architect's knowledge as Contract Administrator or for the Owner.

B. Submit for information for the limited purpose of assessing conformance with the information given and the design concept expressed in the Contract Documents.

1.08 TEST REPORTS

A. Submit simultaneously to the Architect and the Owner.

B. Submit for review for the limited purpose of assessing conformance with the information given and the design concept expressed in the Contract Documents.

1.09 CERTIFICATES

A. When specified in the individual specification Sections, submit certification by the manufacturer, installation/applicator subcontractor, or Contractor to the Architect, in the quantities specified for the Product Data.

B. Indicate that the material or product conforms to or exceeds the specified requirements. Submit supporting reference data, affidavits and certifications as appropriate.

C. Certificates may be recent or previous test results on the material or product, but must be acceptable to the Architect.

1.10 MANUFACTURER'S INSTRUCTIONS

A. When specified in the individual specification Sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting and finishing to the Architect for delivery to the Owner in the quantities specified for the Product Data.

B. Indicate the special procedures, the perimeter condition requiring special attention and the special environmental criteria required for application or installation.

1.11 MANUFACTURER'S FIELD REPORTS

A. Submit reports for the Architect's benefit as Contract Administrator or for the Owner.

B. Submit the report in duplicate within 30 days of observation to the Architect for information.

C. Submit for review for the limited purpose of assessing conformance with the information given and the design concept expressed in the Contract Documents.

1.12 ARCHITECT'S ACTION

A. GENERAL: Except for submittals for the record and similar purposes, where action and return on submittals is required or requested, the Architect will review each submittal, mark with appropriate "Action", and where possible return within Five (5) calendar days of receipt. Where the submittal must be held for coordination the Architect will so advise the Contractor without delay.

B. ACTION STAMP: The Architect will stamp, sign and date each submittal copy to be returned to Contractor and indicate disposition of each submittal in accordance with the following grading requirements:

1. "Approved" or "Reviewed" indicates that Architect notes not exception to the intent of the Contract Documents. Fabrication of item may commence.

2. "Not Approved" or "Rejected" indicates nonconformance with the Contract requirements. The Architect will state the reasons for rejections.

3. "Revise and Resubmit" indicates nonconformance with the Contract requirements or that too many corrections would be necessary. No fabrication may commence.

4. "Furnish As Corrected" indicates that the Architect notes changes needed to the intent of the Contract Documents. The Contractor is responsible for completing all noted changes.

C. ARCHITECT'S REVIEW

1. Architect's review of submitted drawings and data will cover only general conformity to drawings and specification, external connections and dimensions which affect layout.

2. Architect's review does not indicate thorough review of all dimensions.

3. **Architect's review of submittals does not relieve Contractor's responsibility for errors, omissions or deviations, field verification of all dimensions nor responsibility for compliance with Contract Documents.**

1.13 RESUBMISSION REQUIREMENTS

A. Make any corrections or changes in the submittals required by the Architect and resubmit until they are denoted "Approved", "Reviewed", "Approved as Noted" or "Furnish As Corrected" by the Architect. Resubmission requirements specified in individual specifications Sections, which differ from these requirements, will take precedence over these requirements.

B. SHOP DRAWINGS AND PRODUCT DATA

1. Revise initial drawings or data, and resubmit as specified for the initial submittal.

2. Indicate any changes which have been made other than those requested by the Architect.

C. SAMPLES: Submit new samples as required for initial submittal.

1.14 DISTRIBUTION

A. Distribute reproductions of shop drawings and copies of product data which carry the Architect's stamp denoting "Approved", "Reviewed", "Approved as Noted" or "Furnish As Corrected" to:

1. Job site file; Record documents file.

2. Subcontractors; Supplier or fabricator.

B. Distribute samples which carry the Architect's stamp denoting "Approved", "Reviewed", "Approved as Noted" or "Furnish As Corrected" as directed by the Architect.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01 33 00

CCRI CHILLER REPLACEMENT
Newport Campus
Newport, Rhode Island 02840 AA# 19160

SECTION 01 45 00
QUALITY CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Quality assurance and control of installation.

B. Verification of Credentials and Licenses

C. Tolerances.

D. References.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittal Procedures: Submission of Manufacturers' Instructions and Certificates.

B. Section 01 60 00 – Product Requirements: Requirements for material and product quality.

1.03 QUALITY ASSURANCE/CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions and workmanship, to produce Work of specified quality.

B. Comply fully with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes or specified requirements indicate higher standards or more precise workmanship.

E. Perform work by persons qualified to produce workmanship of specified quality.

F. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.04 VERIFICATION OF CREDENTIALS AND LICENSES

A. The Owner has implemented a project management oversight process and is applying it to current construction projects at CCRI.

B. An element of this oversight process is the verification that persons employed on the Project site have appropriate and current credentials and licenses in their possession, at the Project site, for the work they are performing.

C. Those persons without appropriate and current credentials and licenses will be subject to dismissal from the Project site.

1.05 TOLERANCES

A. Monitor the fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. When the manufacturers' tolerances conflict with the Contract Documents, request clarification from the Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

1.06 REFERENCES

A. For products or workmanship specified by association, trade or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable Codes.

B. Conform to reference standard by date of issue current on date of Contract Documents, except where a specific date is established by Code.

C. Obtain copies of standards when required by Contract Documents.

D. Should specified reference standards conflict with Contract Documents, request clarification for Architect before proceeding.

E. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01 45 00

SECTION 014533
CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Code-required special inspections.

1.02 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary 2014 (Errata 2018).

B. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel 2018.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SPECIAL INSPECTIONS FOR CONCRETE CONSTRUCTION

A. Reinforcing Steel, Including Prestressing of Tendons and Placement: Verify compliance with approved Contract Documents and ACI 318, Sections 3.5 and 7.1 through 7.7; periodic.

B. Reinforcing Steel Welding: Verify compliance with AWS D1.4/D1.4M and ACI 318, Section 3.5.2; periodic.

C. Design Mix: Verify plastic concrete complies with the design mix in approved Contract Documents and with ACI 318, Chapter 4 and 5.2; periodic.

D. Specified Curing Temperature and Techniques: Verify compliance with approved Contract Documents and ACI 318, Sections 5.11 through 5.13; periodic.

E. Concrete Strength in Situ: Verify concrete strength complies with approved Contract Documents and ACI 318, Section 6.2, for the following.

F. Formwork Shape, Location and Dimensions: Verify compliance with approved Contract Documents and ACI 318, Section 6.1.1; periodic.

END OF SECTION

CCRI CHILLER REPLACEMENT
Newport Campus
Newport, Rhode Island 02840 AA# 19160

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Products, materials and equipment.

B. Transportation and handling.

C. Storage and protection.

D. Product options.

E. Substitutions.

1.02 RELATED SECTIONS

A. Document 00 21 13 - Instructions to Bidders: Product options and substitution procedures.

B. Section 01 45 00 - Quality Control: Product quality monitoring.

1.03 MANUFACTURED AND FABRICATED PRODUCTS

A. Design, fabricate and assemble in accordance with the best engineering and shop practices.

B. Manufacture like parts of duplicate units to standard sizes and gages, to be interchangeable.

C. Two or more items of the same kind shall be identical, by the same manufacturer.

D. Products shall be suitable for service conditions.

E. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically reviewed by Architect.

F. Do not use material or equipment for any purpose other than that for which it is designed or is specified.

1.04 MATERIAL AND EQUIPMENT INCORPORATED INTO THE WORK

A. Conform to applicable specifications and standards.

B. Comply with size, make, type and quality specified within these specifications and construction documents or as specifically reviewed by the Architect.

1.05 MANUFACTURER'S INSTRUCTIONS

A. When the Contract Documents require that installation of Work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, as specified in Section 01 33 00 – Submittal Procedures.

B. Maintain one set of complete instructions at the job site during installation and until completion.

C. Handle, install, connect, clean, condition and adjust products in strict accordance with such instructions and in conformity with specified requirements.

D. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Architect for further instructions.

E. Do not proceed with Work without clear instructions.

F. Perform Work in accordance with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by the Contract Documents.

1.06 CERTIFICATES OF CONFORMANCE AND MANUFACTURE

A. In addition to other requirements specified herein, the Contractor shall furnish to the Architect, as specified in Section 01 33 00 - Submittals, notarized certificates of conformance and manufacture that all materials and/or equipment to be furnished under this Contract meet the specification requirements. When directed, each shipment of material shall be accompanied by the manufacturer's notarized certificates of conformance and manufacture. Unless otherwise specifically specified, all testing of materials shall be provided by the Contractor at no additional expense to the Owner.

B. Each manufacturer's certificate shall be endorsed or accompanied by the Contractor's certificate that the material certified by the manufacturer will be the material incorporated in the Work.

1.07 TRANSPORTATION AND HANDLING

A. Arrange deliveries of products in accordance with construction and CCRI school schedules, coordinate to avoid conflict with Work, conditions at the site, CCRI daily operations and also when two or more trades, contractors or suppliers are involved.

B. Transport all materials and equipment on legally approved conveyances as required or recommended by the respective manufacturer, supplier, and CCRI.

C. Deliver products in undamaged condition, in manufacturer's original containers or packaging with identifying labels intact and legible.

D. Receive and handle all materials and equipment, at the Project site, by conveyances or methods as recommended by the respective manufacturer or supplier to prevent damage to products.

E. Immediately on delivery, inspect shipments to assure compliance with requirements of Contract Documents and reviewed submittals, and that products are properly protected and undamaged.

F. Remove from the site any material or item of equipment damaged during the transportation or handling process, and immediately replace at no additional cost to the Owner.

1.08 STORAGE AND PROTECTION

A. Coordinate on site storage locations with CCRI staff.

B. Store products in accordance with the manufacturer's instructions, with seals and labels intact and legible.

C. Store products subject to damage by the elements in weathertight enclosures.

D. Maintain temperature and humidity within the ranges required by manufacturer's instructions.

E. Storage does not exist within the building. Maintain all storage areas in a clean and orderly condition at all times.

1.09 EXTERIOR STORAGE

A. No products shall be stored outside.

1.10 PROTECTION AFTER INSTALLATION

A. Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove when no longer needed.

1.11 PRODUCT OPTIONS

A. PRODUCTS SPECIFIED BY REFERENCE STANDARDS OR BY DESCRIPTION ONLY: Any product meeting those standards or description.

B. PRODUCTS SPECIFIED BY NAMING ONE OR MORE MANUFACTURERS: Products of manufacturers named and meeting specifications, no options or substitutions allowed.

C. PRODUCTS SPECIFIED BY NAMING ONE OR MORE MANUFACTURERS WITH A PROVISION FOR SUBSTITUTIONS: Submit a request for substitution for any manufacturer not named.

1.12 SUBSTITUTIONS

A. Instructions to Bidders specify time restrictions for submitting requests for Substitutions during the bidding period to requirements specified in this Section.

B. Thereafter, Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

D. A REQUEST CONSTITUTES A REPRESENTATION THAT THE CONTRACTOR:

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.

4. Waives claims for additional costs or time extension that may subsequently become apparent.
5. Will reimburse Owner for review or redesign services associated with re-approval by authorities.

E. **Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.**

F. SUBSTITUTION SUBMITTAL PROCEDURE

1. Submit four copies of request for Substitution for consideration. Limit each request to

one proposed Substitution.

2. Submit shop drawings, product data and certified test results attesting to the proposed product equivalence.

3. The Architect will notify the Contractor, in writing, of decision to accept or reject request.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01 60 00

SECTION 01 78 00
CLOSEOUT PROCEDURES AND SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Closeout Procedures.

B. Requirements.

C. Substantial Completion.

D. Final Review.

E. Additional Reviews.

F. Submittals.

G. Final Adjustment of Accounts.

H. Final Application for Payment.

I. Final Cleaning.

J. Adjusting.

K. Operation and Maintenance Data.

L. Warranties.

M. Spare Parts and Maintenance Materials.

1.02 RELATED SECTIONS

A. Section 01 78 39 – Project Record Documents.

1.03 REQUIREMENTS

A. Comply with requirements stated in conditions of the Contract and in specifications for administrative procedures in closing out the Work.

1.04 SUBSTANTIAL COMPLETION

A. When Contractor considers the work is Substantially Complete, he/she shall submit to the Architect:

1. A written notice that the Work or designated portion thereof, is Substantially Complete.

2. A list of items to be completed or corrected.

B. Within a reasonable time after receipt of such notice, Architect will review the Work to determine the status of completion.

C. Should Architect determine that the Work is not Substantially Complete:

1. Architect will promptly notify the Contractor in writing, giving the reasons therefor.

2. Contractor shall remedy the deficiencies in the work and send out another written notice of substantial completion to the Architect.

3. Architect will again review the work.

D. When Architect concurs that the Work is Substantially Complete, he will:

1. Prepare a Certificate of Substantial Completion, accompanied by Contractor's list of items to be completed or corrected, as verified and amended by the Architect.

2. Submit the certificate to Owner, Contractor and manufacturer for their written acceptance of the responsibilities assigned to them in the certificate.

1.05 FINAL REVIEW

A. When Contractor considers the Work is complete, he shall submit written certification that:

1. Contract documents have been reviewed.

2. Work has been inspected for compliance with Contract Documents.

3. Work has been completed in accordance with Contract Documents.

4. Equipment and systems have been tested in the presence of the Owner's representative and are operational.

5. Work is completed and ready for final review.

B. Architect will make final review to verify the status of completion with reasonable promptness after receipt of such certification.

C. Should Architect consider that the Work is incomplete or defective:

1. Architect will promptly notify the Contractor in writing, listing the incomplete or defective work.

2. Contractor shall take immediate steps to remedy the stated deficiencies and send out another written certification to Architect that the work is complete.

3. Architect will again review the Work.

4. Should Architect consider that the Work is still incomplete or defective, all subsequent reviews shall be considered as Additional Reviews, subject to the provisions listed in 1.06 below.

D. When the Architect finds that the Work is acceptable under the Contract Documents and that all Punch List items have been accomplished to his satisfaction, he shall request the Contractor to make closeout submittals.

1.06 FEES FOR ADDITIONAL REVIEWS

A. Should Architect perform additional reviews due to failure of the Work to comply with the claims of status of completion made by the Contractor:

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.

1.07 CONTRACTOR'S CLOSEOUT SUBMITTALS TO ARCHITECT

A. OPERATING AND MAINTENANCE DATA: Submit documentation as described in 1.12 below.

B. WARRANTIES, GUARANTEES AND BONDS: Submit documentation as described in 1.13 below.

C. SPARE PARTS AND MAINTENANCE MATERIALS FOR OWNER: Submit documentation as described in 1.14 below.

D. Contractor's affidavit of payment of debts and claims.

E. Contractor’s affidavit of release of liens.

F. Consent of surety to final payment.

G. Certificate of insurance for products and completed operations.

H. PROJECT RECORD DRAWINGS: Submit documentation as described in Section 01720.

1.08 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit a final statement of accounting to Architect.

B. Statement shall reflect all adjustments to the Contract Sum:

1. The original Contract Sum.

2. Additions and deductions resulting from:

a. Previous Change Orders, allowances and unit prices.

b. Deductions for uncorrected work, liquidated damages and re-inspection payments.

c. Other adjustments.

3. Total Contract Sum, as adjusted.

4. Previous payments.

5. Sum remaining due.

C. Architect will prepare a final change order reflecting approved adjustments to the Contract sum that were not previously made by Change Orders.

1.09 FINAL APPLICATION FOR PAYMENT

A. Contractor shall submit the final application for payment in accordance with procedures and requirements stated in the General Conditions.

1.10 FINAL CLEANING

A. Execute final cleaning prior to final inspection.

B. Clean interior surfaces exposed to view; remove temporary labels, stains and foreign substances, vacuum resilient, carpeted and soft surfaces.

C. Clean equipment and fixtures to a sanitary condition.

D. Remove waste and surplus materials, rubbish and construction facilities from the site.

1.11 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

1.12 OPERATION AND MAINTENANCE DATA

A. Submit one copy of completed volumes in final form 5 days prior to final inspection. This copy will be returned with Architect/Engineer comments. Revise content of documents as required prior to final submittal.

B. Submit Operation and Maintenance Data; Three (3) bound and three (3) electronic copies. Bound copies in 8-1/2 x 11 inch text pages, three D side-ring capacity expansion binders with durable plastic covers. Prepare binder covers and electronic copies with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project and subject matter of binder when multiple binders are required.

C. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

D. CONTENTS: Prepare a Table of Contents for each volume, with each Product or system description identified, type on 24 pound white paper.

E. PART 1: Directory, listing names, addresses and telephone numbers of Architect, Engineers, Contractor, Subcontractors and major equipment suppliers.

F. PART 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses and telephone numbers of Subcontractors and suppliers. Identify the following:

1. Significant design criteria.

2. List of equipment.

3. Parts list for each component.

4. Operating instructions.

5. Maintenance instructions for equipment and systems.

6. Maintenance instructions for all finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.

G. PART 3: Project documents and certificates, including the following:

1. Shop drawings and product data.

2. Certificates.

3. Photocopies of warranties and bonds.

I. Submit final volumes revised, within ten days after final inspection.

1.13 WARRANTIES

A. Provide duplicate notarized copies.

1. In addition to the Warranty and Guarantee Requirements of the General Conditions, provide all other guarantees, bonds, affidavits and certifications required throughout the Project Manual.

B. Execute and assemble documents from Subcontractors, suppliers and manufacturers.

C. Provide Table of Contents and assemble in three D side-ring binder with durable plastic cover.

D. Submit prior to final Application for Payment.

E. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.14 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections.

B. Deliver to Project site and place in location as directed by the Owner; obtain receipt prior to final payment.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01 78 00

SECTION 01 78 39
PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

1. Project Record Documents required for Contract closeout.

1.02 RELATED SECTIONS

A. Section 01 78 00 – Closeout Procedures and Submittals.

1.03 REQUIREMENTS

A. Maintain at the site for the Owner one record copy of:

1. Drawings
2. Specifications
3. Addenda
4. Change Orders and other modifications to the Contract
5. Architect field orders or written instructions
6. Reviewed shop drawings, product data and samples

1.04 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Store documents and samples in Contractor's field office apart from documents used for construction.

B. Provide locked file cabinet for storage of documents and samples.

C. File documents and samples in accordance with CSI/CSC format.

D. Maintain documents in a clean, dry, legible condition and in good order. Do not use Record Documents for construction purposes.

E. Make documents and samples available at all times for inspection by Architect and Owner.

1.05 MARKING DEVICES

A. Provide felt tip marking pens for recording information in the color code designated by Architect.

1.06 RECORDING

A. Label each document "Project Record" in neat large printed letters.

B. Record information concurrently with construction progress.

C. Do not conceal any work until required information is recorded.

D. DRAWINGS: Principal dimensions, elevations and other data as required shall be recorded for all work, such as:

1. Deviations of any nature made during construction.

2. Location of underground utilities.

3. Field changes of dimension and detail.

4. Changes made by field order or by Change Order.

5. Details not on original Contract Drawings.

E. The marked-up prints shall be inspected weekly by the Architect and shall be corrected immediately if found either inaccurate or incomplete.

F. SPECIFICATIONS AND ADDENDA: Legibly mark each Section to record:

1. Manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed.

2. Changes made by field order or by Change Order.

1.07 FINAL MEASUREMENTS

A. The Contractor shall provide qualified personnel and equipment for taking final measurements for quantities and Record Documents.

1.08 RECORD DRAWINGS

A. Submit documents to Architect with claim for final Application for Payment for review & comment.

1. Submit two electronic copies and one print copy of all documents.

B. The Contractor shall correct, amplify and do all other work as may be required by the Architect to complete the drawings in a manner satisfactory to the Architect and at no additional cost to the Owner.

C. Upon approval, the Contractor shall provide a final Record Drawing set, two electronic copies and one print copy (electronic format (PDF, heavyweight bond). The bond and electronic version shall be submitted to the Owner by the Architect.

1.09 SUBMITTAL

A. At Contract close-out, deliver Record Documents to Architect for the Owner.

B. Accompany submittal with transmittal letter in duplicate, containing:

1. Date.

2. Project title and number.

3. Contractor's name and address.

4. Title and number of each record document.

5. Signature of Contractor or his authorized representative.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION 01 78 39

CCRI CHILLER REPLACEMENT
Newport Campus
Newport, Rhode Island 02840 AA# 19160

SECTION 02 41 13
SELECTIVE DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Demolition and removal of selected building elements.

B. Repairs.

1.02 RELATED SECTIONS

A. Section 01 10 00 – Summary of Work: Use of the premises.

1.03 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.

1.04 MATERIALS OWNERSHIP

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

1.05 QUALITY ASSURANCE

A. REGULATORY REQUIREMENTS: Comply with governing EPA notification regulations before starting selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.07 PROJECT CONDITIONS

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

B. Owner assumes no responsibility for actual condition of building elements to be selectively demolished.

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

1.08 SCHEDULING

A. Arrange selective demolition schedule so as not to interfere with Owner's on-site operations.

1.09 WARRANTY

A. EXISTING SPECIAL WARRANTY: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 PRODUCTS

2.01 REPAIR MATERIALS

A. Use repair materials identical to existing materials.

1. Where 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.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that utilities have been disconnected and capped, if necessary.

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.

D. When unanticipated mechanical, electrical or structural elements that conflict with the intended function or design are encountered, investigate and measure the nature and extent of the conflict. Promptly submit a written report to the Architect.

E. Survey the condition of the building to determine whether removing any element might result in damage to of any portion of the structure or adjacent structures during selective demolition.

F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.02 UTILITY SERVICES

A. Maintain all existing utilities in service 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 and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to governing authorities.

2. Provide not less than 72 hours' notice to Owner if shutdown of service is required during changeover.

3. Owner will arrange to shut off indicated utilities when requested by Contractor.

3.03 PREPARATION

A. Remove, collect and dispose of any dangerous materials before proceeding with selective demolition operations.

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

1. Do not close or obstruct streets, walks or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

D. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around selective demolition area.

1. Erect temporary protection, such as walks, fences, railings, canopies and covered passageways, where required by authorities having jurisdiction.

2. Protect existing site improvements, appurtenances and landscaping to remain.

3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.

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

5. Protect existing finish work that is to remain and is exposed during selective demolition operations.

6. Protect equipment that has not been removed.

E. Erect and maintain weatherproof temporary closures to as required to protect the building interior from the elements.

3.04 POLLUTION CONTROLS

A. Use water mist, temporary enclosures and other suitable methods to limit the 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. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

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

3.05 SELECTIVE DEMOLITION

A. Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level.

2. Use cutting methods least likely to damage construction to remain or adjoining construction. To minimize disturbance of adjacent surfaces, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.

3. Do not use cutting torches.

4. Remove decayed, vermin-infested or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

5. Remove debris from elevated portions of building by chute, hoist or other device that will convey debris to grade level.

6. Dispose of demolished items and materials promptly. On-site storage or sale of removed items is prohibited.

7. Return elements of construction and surfaces scheduled to remain to condition existing before start of selective demolition operations.

B. Remove no more existing roofing than can be covered in one day by new roofing. See Sections 07 54 23 for new roofing requirements.

3.06 REPAIRS

A. Promptly any repair damage caused to adjacent construction by selective demolition operations.

B. Repairs shall be as required to restore existing construction to original condition at a minimum.

3.07 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.

3.08 CLEANING

A. Sweep the building and grounds broom clean on completion of selective demolition operation.

END OF SECTION 02 41 13

AHARONIAN & ASSOCIATES INC. - ARCHITECTS

310 George Washington Highway - Suite 100 - Smithfield, Rhode Island 02917 T 401-232-5010 F 401-232-5080

CCRI CHILLER REPLACEMENT
Newport Campus
Newport, Rhode Island 02840 AA# 19160

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Slab-on-Grade.

2. Equipment Pads.

1.03 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.04 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. Field quality-control test and inspection reports.

1.05 QUALITY ASSURANCE

A. 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."

B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

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."

E. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.02 FORM-FACING MATERIALS

A. 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.

B. 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.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

C. 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 (25 mm) to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.

2.03 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60.

B. Plain-Steel Wire: ASTM A 82.

C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.04 REINFORCEMENT ACCESSORIES

A. 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:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.05 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/II.

B. Normal-Weight Aggregates: ASTM C 33. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

2.06 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.
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.
5. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

C. Plastic Vapor Retarder: ASTM E 1745, Class C or polyethylene sheet, ASTM D 4397, not less than 10 mils. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.

1. Fortifuber Corporation; Moistop Plus.
2. Raven Industries Inc.; Dura Skrim 6.
3. Reef Industries, Inc.; Griffolyn Type-65.
4. Stego Industries, LLC; Stego Wrap, 10 mils.

D. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

2.07 CURING MATERIALS

A. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Available Products:

a. Burke by Edoco; Cureseal 1315 WB.
b. ChemMasters; Polyseal WB.
c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315 WB.
d. Euclid Chemical Company (The); Super Diamond Clear VOX.
e. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
f. Lambert Corporation; UV Safe Seal.
g. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
h. Meadows, W. R., Inc.; Vocomp-30.
i. Metalcrete Industries; Metcure 30.
j. Symons Corporation, a Dayton Superior Company; Cure & Seal 31 Percent E.
k. Tamms Industries, Inc.; LusterSeal WB 300.
l. Unitex; Hydro Seal 25.
m. US Mix Products Company; US Spec Radiance UV-25.
n. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.

2.08 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.09 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

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. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture in all concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Interior Concrete

1. Minimum Compressive Strength: 4,000 psi (27.6 MPa**)** at 28 days.
2. Minimum Cementitious Materials Content: 564 lb/cu. yd. (335 kg/cu. m).
3. Slump Limit: 5 inches (125 mm**),** plus or minus 1 inch (25 mm).
4. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.

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 furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 EXECUTION

3.01 FORMWORK

A. Design, erect, brace, and maintain formwork, according to ACI 301, to support 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 (3.2 mm) for smooth-formed finished surfaces.
2. Class B, 1/4 inch (6 mm) 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. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. 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.

G. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

H. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

I. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 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."

3.03 VAPOR RETARDERS

A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

B. Granular Course: Compact granular fill with mechanical equipment to elevation tolerances of plus 0 inch (0 mm) or minus 3/4 inch (19 mm).

3.04 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

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 tack weld crossing reinforcing bars.

3.05 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.

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 (150 mm) 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. 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 (4.4 deg C) 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 or chemical accelerators unless otherwise specified and approved in mixture designs.

F. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F (32 deg C) 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.

3.06 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 public view.

B. 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.

3.07 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, re-straightening, 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. Re-straighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and re-straighten 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 trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:

   a. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.

3. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-foot- (3.05-m-) long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 3/16 inch (4.8 mm).

D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.08 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.

3.09 CONCRETE PROTECTING AND CURING

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 unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m 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 underside of beams, 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 one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), 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.

   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
   c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project..

3. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.10 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semi rigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.11 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. 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 (1.18-mm) 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 (25 mm) 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 (0.25 mm) 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. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) 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 (19-mm) 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.
7. Repair random cracks and single holes 1 inch (25 mm) 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.

3.12 FIELD QUALITY CONTROL

A. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports as applicable.

B. 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 one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
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 (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31/C 31M.
   a. Cast and laboratory cure four standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C 39/C 39M; test one laboratory-cured specimen at 7 days and three 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.
8. 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.
9. 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 (3.4 MPa).

10. Test results shall be reported in writing to Architect, Structural Engineer, 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.

END OF SECTION 03 30 00

CCRI CHILLER REPLACEMENT
Newport Campus
Newport, Rhode Island 02840 AA# 19160

SECTION 07 84 00
FIRESTOPPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The requirements of the General Conditions, Supplementary Conditions, and Division 1 General Requirements, apply to the Work of this Section.

B. Coordinate work of this Section with the work of the following Sections to properly execute the work in order to maintain the hourly ratings of the walls and floors.
1. Division 1 General Conditions
2. Division 21-23 Mechanical, Plumbing

1.02 REFERENCES

A. American Society for Testing and Materials Standards (ASTM):
1. ASTM E 814 - 88: Standard Test method For Fire Tests of Through-Penetration Firestops

B. Underwriters Laboratories Inc.
1. UL 1479 Fire Tests of Through-Penetration Firestops (Consult UL Fire Resistance Directory)

1.03 DESCRIPTION

A. This Section describes the requirements for furnishing and installing firestopping for fire-rated construction, this includes:
1. All openings in fire-rated floors and wall assembles, both blank (empty) and those accommodating penetrating items such as cables, conduits, pipes ducts, etc.
2. Gaps (openings) between exterior curtain walls and the outer perimeter edge of the structural floor.
3. Openings at each floor level in shafts or stairwells.

B. Perform all work required, and furnish all materials necessary, to complete proper installation of firestops and firestop systems in fire-rated walls, floors, and partitions, around penetrations of pipe, duct, cable, other electrical/mechanical devices or in blank openings. Refer to Architectural Drawings for locations of all fire-rated construction. All penetrations of fire-rated construction shall be firestopped in a manner which is acceptable to the authority having jurisdiction.

1.04 QUALITY ASSURANCE

A. Firestopping systems (materials and design) shall conform to both Flame (F) ard Temperature (T) ratings as required by local building code ard as tested by notionally accepted test agencies per ASTM E814 or UL 1479 fire tests in a configuration that is representative of field conditions. The F rating must be a minimum of one (1) hour but not less than the fire resistance rating of the assembly being penetrated. T rating when required by code authority shall be based on measurement of the temperature rise on penetrating item(s). The fire test shall be conducted

with a minimum positive pressure differential of 0.01 inches of water column.

B. Firestopping materials & systems must be capable of closing or filling through-openings created by 1) the burning or melting of combustible pipes, cable jacketing, or pipe insulation materials, or 2) deflection of sheet metal due to thermal expansion (electrical & mechanical duct work).

C. Firestopping material shall be asbestos free and shall not incorporate nor require the use of hazardous solvents.

D. Firestopping materials shall not shrink upon drying as evidenced by cracking or pulling back from contact surfaces.

E. Do not use any Firestop products which after curing dissolve in water.

F. All Firestopping materials shall be manufactured by one manufacturer (to the maximum extent possible).

G. Installation of Firestopping systems shall be performed by a contractor (or contractors) trained or approved by the Firestop manufacturer.

H. Equipment used shall be in accordance with the Manufacturer’s written installation instructions.

1.05 SUBMITTALS

A. Submit manufacturer's product literature for each type of Firestop material to be installed. Literature shall indicated product characteristics, typical uses, performance and limitation criteria and test data.

B. Material Safety Data Sheets (MSDS): Submit MSDS for each firestop product.

C. Shop drawings: Show typical installation details for the methods of installation. Indicate which firestop materials will be used where and thickness for different hourly ratings

D. Submit manufacturer's installation procedures for each type of product.

E. Installer documentation: Submit document form Firestop Manufacturer wherein Manufacturer recognizes, i.e. approves Installer for said Manufacturer's Firestop products.

F. Upon completion, installer shall provide written certification that materials were installed in accordance with the manufacturer's installation instructions and details.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver material in the manufacturer's original, unopened containers or packages with the manufacturer's name, product identification, lot number, UL label, and mixing and installation instructions as applicable.

B. Store materials in the original, unopened containers or packages, and under conditions recommended by the manufacturer.

C. All Firestop materials shall be installed prior to expiration of shelf life.

1.07 PROJECT CONDITIONS

A. Conform to Manufacturer's printed instructions for installation and when applicable, curing in accordance with temperature and humidity. Conform to ventilation and safety requirements.

1.08 SEQUENCING

A. Coordinate this work as required with the work of other trades.

B. Firestopping shall precede gypsum board finishing.

1.09 PROTECTION

A. Where firestopping is installed at locations which will remain exposed in the completed work, provide protection as necessary to prevent damage to adjacent surfaces and finishes, and protect as necessary against damage from other construction activities.

PART 2 PRODUCTS

2.01 GENERAL

A. Firestopping materials and systems shall meet the requirements specified herein.

B. Architect must approve in writing any alternates to the materials and systems specified herein.

C. All firestop products and systems shall be designed and installed so that the basic sealing system will allow the full restoration of the thermal and fire resistance properties of the barrier being penetrated with minimal repair if penetrants are subsequently removed.

2.02 ACCEPTABLE MANUFACTURERS

A. Specified Technologies Inc. (STI), Somerville, NJ 08876

B. Dow Corning Corp., Midland, MI

C. 3M Fire Protection Products, St. Paul, MN

D. Nelson Firestop Products, Tulsa, OK

2.03 MATERIALS

A. Firestop Mortar
   1. Specified Technologies Inc. SpecSeal Mortar

B. Firestop Sealants and Caulks
   1. STI SpecSeal Sealant
   2. Dow Corning Firestop Sealant No. 2000
   3. 3M CP25WB- Caulk
   4. Nelson Firestop Products - all listed sealants and caulks

C. Firestop Putty
   1. STI SpecSeal Firestop Putty Bars & Pads
   2. 3M MPS-2 Moldable putty Stix & Putty Pads
   3. Nelson Firestop Products FSP Fireseal putty

D. Firestop Collars
   1. STI SpecSeal Firestop Collars
   2. 3M PPD Collars
   3. Nelson Firestop Products PCS preformed collars

E. Wrap Strips
   1. SpecSeal WrapStrip
   2. 3M FS-1 95 Wrap Strip
   3. Nelson Firestop Products wrap strips

F. Accessories
   1. Forming/Damming Materials: Mineral fiberboard or other type recommended by

Manufacturer.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions where Firestops are to be installed and notify the Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected by the contractor in a manner acceptable to the Architect.

B. Verify that environmental conditions are safe and suitable for installation of Firestop products.

3.02 CONDITIONS REQUIRING FIRESTOPPING

A. General
1. All through-penetrations, construction gaps, joints and through openings occurring in, adjacent to or between fire-rated floor/ceilings and walls shall be firestopped as per the requirements of this specification.
2. Insulation types specified in other Sections shall not be installed in lieu of firestopping material specified herein.
3. All combustible penetrants (I.E. non-metallic pipes or insulated metallic pipes) shall be firestopped using products and systems tested in a configuration representative of the field condition.

3.03 INSTALLATION

A. General
1. Installation of Firestops shall be performed by a applicator/irstaller qualified and traired by the manufacturer. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.
2. Apply Firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, and manufacturer's recommendations.
3. Coordinate with plumbing, mechanical, electrical and other trades to assure that all pipe, conduit, cable, and other items which penetrate fire-rated construction have been permanently installed prior to installation of Firestops. Schedule and sequence the work to assure that partitions and other construction which would conceal penetrations are not erected prior to the installation of Firestops.
4. Unless specified and approved, all insulations used in conjunction with through-penetrants shall remain intact and undamaged and may not be removed.

B. Dam Construction
1. When required to properly contain Firestopping materials within openings, damming or packing materials may be utilized. Combustible damming material must be removed after appropriate curing. Noncombustible damming materials may be left as a permanent component of the Firestop system.

C. Field Quality Control
1. Prepare and install firestopping systems in accordance with manufacturer's printed instructions and recommendations.
2. Follow safety procedures recommended in the Material Safety Data Sheets.
3. Finish surfaces of firestopping which are to remain exposed in the completed work to a uniform and level condition.
4. All areas of work must be accessible until inspection by the applicable Code Authorities.
5. Correct unacceptable firestops and provide additional inspection to verify compliance with this specification at no additional cost.

3.04 CLEANING

A. Remove spilled and excess materials adjacent to firestopping without damaging adjacent surfaces.

B. Leave finished work in neat, clean condition with no evidence of spillovers or damage to adjacent surfaces.

END OF SECTION 07 84 00

SECTION 07 84 13
PENETRATION FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Penetration firestopping systems for penetrations through fire-resistance rated constructions, including both empty openings and openings containing penetrating items.

1.02 RELATED SECTIONS

A. Division 21, 22 and 23 Sections specifying duct and piping penetrations.

B. Division 26, 27 and 28 Sections specifying cable and conduit penetrations.

1.03 PERFORMANCE REQUIREMENTS

A. GENERAL: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide penetration firestopping 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 construction penetrated.

1. Fire-resistance-rated walls.

2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies and ceiling membranes of roof/ceiling assemblies.

B. RATED SYSTEMS: Provide penetration firestopping systems with the following ratings determined per ASTM E 814:

1. F-RATED SYSTEMS: Provide penetration firestopping systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

2. T-RATED SYSTEMS: Provide T-Rated systems for all conditions required by the RI State Building and Fire Codes.

C. For penetration firestopping exposed to view, traffic, moisture and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.

2. For floor penetrations with annular spaces exceeding 4-inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.

D. For penetrations involving insulated piping, provide penetration firestopping systems not requiring removal of insulation. For penetration firestopping exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.04 SUBMITTALS

A. Submit the following under provisions of Section 01 33 00:

B. PRODUCT DATA: For each type of product indicated.

C. SHOP DRAWINGS: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.

2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for 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.

D. PENETRATION FIRESTOPPING SCHEDULE: Indicate locations of each penetration firestopping system using the form in Part 3 of this Section including the following information:

1. Copies of manufacturer’s UL system drawings for each item in the schedule.

2. Copies of drawings by the manufacturer for special conditions that have not been UL Tested.

3. A copy of the approved schedule and manufacturer’s drawings shall be maintained in the field as a guide for installation.

E. QUALIFICATION DATA: For Installer.

F. PRODUCT TEST REPORTS: From a qualified testing agency indicating penetration firestopping system complies with requirements, based on comprehensive testing of current products.

1.05 QUALITY ASSURANCE

A. INSTALLER QUALIFICATIONS: A firm experienced in installing penetration firestopping 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. Firm shall be approved by FMG according to FMG 4991, "Approval of Firestop Contractors."

1. Installer's responsibilities include providing professional engineering services needed to assume engineering responsibility for designation of restrained and unrestrained conditions.

2. All work of this Section and Section 07 81 00 shall be performed by a single firm.

3. Contractor shall be a member of the “Firestop Contractors International Association” (FCIA) in good standing.

4. Contractor shall have completed no less than five (5) projects of comparable size and complexity.

5. In the event the this Contractor has need to propose subcontracted services during the course of the project, the proposed firm must be approved by the Architect, be a member in good standing

with the FCIA and have also completed no less than five (5) projects of comparable size and complexity.

B. INSTALLATION RESPONSIBILITY: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.

C. SOURCE LIMITATIONS: Obtain penetration firestopping systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.

D. FIRE-TEST-RESPONSE CHARACTERISTICS: Provide penetration firestopping systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.

2. Penetration firestopping systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:

a. Penetration firestopping system products bear classification marking of qualified testing and inspecting agency.

b. Penetration firestopping systems correspond to those indicated by reference to penetration firestopping system designations listed by UL in its "Fire Resistance Directory".

E. Simultaneous with the submission of the firestop system submittals, the Contractor shall schedule a pre-installation conference with the firestop system manufacturer's technical representative. The conference shall be attended by the on-site foreman of each trade that is required to provide firestopping systems. The purpose of the meeting shall be to answer questions, review application procedures and review the requirements for annular spaces, sleeves, etc. to insure that they are properly installed in the walls and floors in accordance with manufacturer's tested systems.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle products under provisions of Section 01 60 00.

B. Deliver penetration firestopping 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 multi-component materials.

C. Store and handle materials for penetration firestopping systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.07 PROJECT CONDITIONS

A. ENVIRONMENTAL LIMITATIONS: Do not install penetration firestopping systems when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet due to rain, frost, condensation or other causes.

B. Ventilate penetration firestopping systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.08 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.
C. Do not cover up penetration firestopping system installations that will become concealed behind other construction until each installation has been examined by inspecting agency and building inspector, if required by authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. AVAILABLE PRODUCTS: Subject to compliance with requirements, through-penetration firestop systems that may be incorporated into the Work include, but are not limited to, those that are produced by one of the following manufacturers:

1. Grace, W. R. & Co.

2. Hilti, Inc.

3. Johns Manville.

4. 3M; Fire Protection Products Division.

B. All firestopping materials shall be from the same manufacturer. Use of different materials between trades is not allowed.

2.02 FIRESTOPPING - GENERAL

A. COMPATIBILITY: Provide penetration firestopping systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating penetration firestopping systems, under conditions of service and application, as demonstrated by penetration firestopping system manufacturer based on testing and field experience.

B. GENERAL REQUIREMENTS

1. Materials shall be free of asbestos.

2. Penetrations through fire rated assemblies shall have an “F” rating equivalent to the rating of the assembly when tested per ASTM E814 or UL 1479, but not less than one hour.

3. Penetrations through horizontal fire rated assemblies shall have a “T” rating equivalent to the rating of the assembly when tested per ASTM E814 or UL 1479, but not less than one hour except for the following locations.

   a. Penetrations within the cavity of a wall assembly.

   b. Penetrations that are not in direct contact with combustible materials.

4. Provide openings for the penetrating items in sizes as required to provide the minimum and maximum annular spaces as noted in the manufacturer’s tested systems.

5. Provide sleeves on metallic piping penetrating concrete or CMU and where required by the manufacturer’s tested systems.

6. Insulation materials shall not pass through the penetration unless so stated in the manufacturers tested assembly.

7. For firestop applications for which no UL tested system is available, the manufacturer shall provide an engineering judgment derived from similar UL system designs or other tests. Engineer judgment drawings must follow requirements set forth by the International Firestop Council.

2.03 ACCESSORIES

A. Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for firestop systems required.

1. Provide penetration firestopping systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of Part 3 by referencing the types of materials described in this Article. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill", "void" or "cavity" materials.

B. PRIMERS: As recommended by firestopping material manufacturer.

C. FORMING AND DAMMING MATERIALS: Shall be as recommended by firestopping material manufacturer and approved for use in accordance with Underwriters Laboratories requirements. Provide support brackets as required and approved by Underwriters Laboratories.

D. SLEEVES: Non-combustible.

2.04 MIXING

A. For those products requiring mixing before application, comply with through-penetration firestop system 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 indicated.

PART 3 EXECUTION

3.01 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 work.

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

3.02 PREPARATION

A. SURFACE CLEANING: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system 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 systems.

2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping systems. 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 penetration firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. MASKING TAPE: Use masking tape to prevent penetration firestopping systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be

permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.03 PENETRATION FIRESTOPPING SYSTEM INSTALLATION

A. GENERAL: Install penetration firestopping systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing 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 firestop systems.

C. Install fill materials for firestop systems 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 Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 IDENTIFICATION

A. Identify penetration firestopping systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6-inches of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems.

B. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted.

C. 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. Through-penetration firestop system designation of applicable testing and inspecting agency.

4. Date of installation.

5. Penetration firestopping system manufacturer's and installer’s names.

3.05 FIELD QUALITY CONTROL

A. INSPECTING AGENCY: Contractor shall engage a qualified, independent inspecting agency to inspect through-penetration firestops. Independent inspecting agency shall comply with ASTM E 2174 requirements including those related to qualifications, conducting inspections, and preparing test reports.

B. MANUFACTURER’S TECHNICAL FIELD REPRESENTATIVE

1. Representative shall visit site weekly to inspect installed systems and installation procedures. Representative shall check that each installer performing work has completed project training program. Representative shall check that only approved materials and systems are being used. Submit written field inspection reports.

C. Where deficiencies are found, repair or replace penetration firestopping systems so they comply with requirements.

D. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

3.06 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system 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 through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated penetration firestopping systems immediately and install new materials to produce systems complying with specified requirements.

3.07 FIRESTOPPING SYSTEM SCHEDULE

A. See next page for Sample.

FIRESTOPPING SYSTEM SCHEDULE (SAMPLE)

PROJECT_____ **CONTRACTOR**_____

FIRESTOPPING SYSTEM MANUFACTURER _____

PENETRATING ITEM	BUILDING MATERIAL	"T" RATING	"F" RATING	PRODUCT	UL SYSTEM NO.
Uninsulated copper pipe – up to 6" diameter	*CMU wall*	.	*3 hr.*	*FS-One*	*CAJ1226*
Uninsulated PVC – up to 6" diameter	*Precast concrete plank*		*3 hr.*	*CP 642 / CP 643*	*CAJ2109*

END OF SECTION 07 84 13

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SECTION 08 71 00
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for doors.

B. Thresholds and gasketing.

1.02 SUMMARY

A. Section Includes
1. Furnishing and installation of all mechanical and electrical finish hardware necessary for all doors, and hardware as specified herein and as enumerated in hardware sets and as indicated and required by actual conditions at the building. The hardware shall include the furnishing of all necessary screws, bolts, expansion shields, drop plates, and all other devices necessary for the proper application of the hardware. Installation shall include field modification and preparation of existing doors and/or frames for new hardware being installed. Provide necessary fillers, Dutchmen, reinforcements and fasteners for mounting new hardware and to cover existing door/frame prep.

1.03 REFERENCES

A. Applicable state and local building codes and standards.

B. FIRE/LIFE SAFETY
1. NFPA – National Fire Protection Associations
a. NFPA 70- National Electric Code
b. NFPA 80 – Standard for Fire Doors and Fire Windows
c. NFPA 101 – Life Safety Code
d. NFPA 105 – Smoke and Draft Control Door Assemblies

C. UL – Underwriters Laboratories
1. UL 10B – Fire Test of Door Assemblies
2. UL 10C – Positive Pressure Test of Fire Door Assemblies
3. UL 1784 – Air Leakage Tests of Door Assemblies.

D. Accessibility
1. Ada – Americans with Disabilities Act.
2. Rhode Island Accessibility Code – SBC 14, 15, 16

E. DHI – Door and Hardware Institute
1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware.

F. ANSI – American national Standards Institute

1. ANSI/BHMA A156.1 – A156.29 and ANSI A156.31 – Standards for Hardware and Specialties.

G. AWI - Architectural Woodwork Institute.

1.04 COORDINATION

A. Coordinate work of this Section with other directly affected Sections involving manufacturer of any internal reinforcement for door hardware.

1.05 QUALITY ASSURANCE

A. MANUFACTURERS: Companies specializing in manufacturing door hardware with minimum ten years documented experience. HARDWARE SUPPLIER: Company specializing in supplying commercial institutional door hardware with ten years documented experience.

B. HARDWARE SUPPLIER PERSONNEL: Employ an Architectural Hardware Consultant (AHC) to assist in the work of this Section; paid directly by General Contractor.

1.06 CERTIFICATIONS

A. Architectural Hardware Consultant shall inspect complete installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions.

B. Provide two copies of certifications to Architect.

1.07 REGULATORY REQUIREMENTS

A. Conform to the applicable sections of Chapter 5 of NFPA 101 and Rhode Island State Building Code.

1.08 SUBMITTALS

A. Submit schedule, shop drawings and product data under provisions of Section 01 33 00.

B. Indicate locations and mounting heights of each type of hardware.

C. Provide product data on specified hardware.

D. Submit manufacturer’s parts lists, templates and installation instructions under provisions of Section 01 33 00.

E. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard NO. 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to the authorities having jurisdiction for use on types and sizes o doors indicated in compliance with requirements of fire-rated door and door frame labels.

F. Electronic Security Hardware: When electrified hardware is included in the hardware specification, the hardware supplier must employ an individual knowledgeable in electrified components and systems, who is capable of producing wiring diagrams and consulting as needed. Coordinate installation of the electronic security hardware with the Architect and electrical engineers and provide installation and technical data to the Architect and other related subcontractors. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.

1.09 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 01 78 00.

B. Include data on operation of hardware, lubrication requirements and inspection procedures related to preventative maintenance.

1.10 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site under provisions of Section 01 60 00.

B. Store and protect products under provisions of Section 01 60 00.

C. Package hardware items individually. Label and identify package with door opening code to match hardware schedule.

D. Deliver keys to Owner by security shipment direct from hardware supplier.

E. Protect hardware from theft by cataloging and storing in secure area.

1.11 WARRANTY

A. Provide Manufacturer's Standard warranty under provisions of Section 01 78 00.

1.12 MAINTENANCE MATERIALS

A. Provide special wrenches and tools applicable to each different or special hardware component.

B. Provide maintenance tools and accessories supplied by hardware component manufacturer.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. BUTTS (Heavy Duty Ball Bearing)

1. Hager Hinge Company
2. Stanley Hardware
3. Ives

B. ELECTRO MECHANICAL AUTOMATIC DOOR OPERATOR

1. Dorma

C. FIRE EXIT AND PANIC DEVICES

1. Von Duprin Inc.

2.02 BUTTS

A. Full Mortise; 4-1/2 x 4-1/2; heavy duty ball bearing; 5 knuckle; square corners; non-removable pins.

B. Provide three hinges per door leaf for door 90 inches or less in height and one additional hinge for each 30 inches of additional door height.

C. Where new hinges are specified for existing doors and /or existing frames, the new hinge size must be identical to hinge preparation present in the existing door and/or existing frame

2.03 ELECTRIC POWER TRANSFER

A. Provide power transfer sufficient for number and gage of wires to accommodate electric function of specified hardware.

B. Electric power transfer is to be located per manufacture's template and UL requirements, unless interference with operation of door or other hardware items.

C. Acceptable manufacturers and/or products: Von Duprin, ABH.

2.04 EXIT DEVICES

A. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit and/or Fire Exit hardware. Cylinders: Refer to KEYING.

B. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel or aluminum, plated to the standard architectural finishes to match the balance of the door hardware.

A. Exit devices shall incorporate a fluid damper or other device that eliminates noise associated with exit device operation. Touchpad shall extend a minimum of one half of the door width, but not the full length of the exit device rail. End-cap will have two-point attachment to door. Touch-pad shall match exit device finish, and shall be stainless steel for US26, US26D, US28, US32, and US32D finishes; for all other finishes, the touch-pad finish shall be of compatible finish to exit device. Only compression springs will be used in devices, latches, and outside trims or controls.

C. Devices to incorporate a deadlatching feature for security and/or for future addition of alarm kits and/or other electrical requirements.

D. Vertical rod devices shall be capable of being field modified to less bottom rod devices by removal of bottom rod and adding firing pin(s), if required at fire rated openings.

E. Provide manufacturer's standard strikes.

F. Provide exit devices cut to door width and height. Locate exit devices at a height recommended by the exit device manufacturer, allowable by governing building codes, and approved by the Architect.

B. Mechanism case shall sit flush on the face of all flush doors, or spacers shall be furnished to fill gaps behind devices. Where glass trim or molding projects off the face of the door, provide glass bead kits.

G. Removable mullions shall be a 2 inches x 3 inches steel tube. Where scheduled, mullion shall be of a type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.

H. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to a 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.
   1. Lever style will match the lever style of the locksets.
   2. Lever trim on doors serving rooms considered by the authority having jurisdiction to be hazardous shall have a tactile warning.

I. Exit devices for fire rated openings shall be UL labeled fire exit hardware.

J. Provide electrical options as scheduled.

K. Acceptable manufacturers and/or products: Von Duprin 98/35 series, No Substitute.

2.05 POWER SUPPLIES

A. Provide power supplies, recommended and approved by the manufacturer of the electrified locking component, for the operation of electrified locks, electrified exit devices, magnetic locks, electric strikes, and other components requiring a power supply.

B. Provide the appropriate quantity of power supplies necessary for the proper operation of the electrified

locking component and/or components as recommended by the manufacturer of the electrified locking components with consideration for each electrified component utilizing the power supply, the location of the power supply, and the approved wiring diagrams. Locate the power supplies as directed by the Architect.

C. Provide a power supply that is regulated and filtered 24 VAC, or as required, and UL class 2 listed.

D. Provide a power supply complete requiring on 120 VAC to the fused input and shall be supplied in an enclosure.

E. Provide a power supply with emergency release terminals, where required, that allow the release of all devices upon activation of the fire alarm system complete with fire alarm input for initiating "no delay" exiting mode.

F. Acceptable manufacturers and/or products: Von Duprin PS900 series, not substitute.

2.06 ELECTRO-MECHANICAL AUTOMATIC OPERATORS

A. Provide low energy automatic operator units that are electro-mechanical design complying with ANSI A156.19 where automatic operators are specified.

B. The operator shall be powered with a DC motor working through reduction gears. Closing shall be spring force. No manual hydraulic or chain drive closer will be acceptable. The motor is to be off when the door is in closing mode. The door can be manually operated with the power on or off without damage to the operator. The operator shall include variable adjustments, including opening and closing speed adjustment. Operator shall be mounted in an aluminum cover.

C. Provide units with manual off/auto/hold-open switch, push and go, function to activate power operator, vestibule interface delay, electric lock delay, hold-open delay adjustable from 2 to 30 secods, and logic terminal to interface with accessories, mats, and sensors.

D. Provide drop plates, brackets or adapters for arms as required to suit details.

E. Provide hard-wired motion sensors and/or actuator switches for operation as specified. Actuators shall be weather-resistant type at exterior applications.

F. Provide key switches, with LED's recommended and approved by the manufacturer of the automatic operator as required for the function as described in the operation description of the hardware sets. Cylinders: Refer to 2.07 Keying.

G. Where automatic operators are scheduled, provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by the manufacturer of the automatic operator for each individual leaf. Actuators shall control both doors simultaneously at pairs. Exterior and vestibule doors with automatic operators shall be sequenced to allow ingress or egress through both sets of openings as directed by the Architect. Locate the actuators, key switches, and other controls as directed by the Architect.

H. Acceptable manufacturers and/or products: Dorma ED-700, no substitute.

2.07 KEYING AND CORES

A. Provide construction cylinders and keys during construction period only.

B. DOOR LOCKS: Keyed as directed by Owner.

C. Supply 4 keys for each lock.

D. Provide cores & cylinders to match existing used on this campus..

2.08 FINISHES

A. FINISHES: 626 (US26D), unless noted otherwise.

PART 3 EXECUTIONS

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive work and dimensions are as indicated on shop drawings.

B. Verify that power supply is available to power operated devices.

C. Beginning of installation means acceptance of existing conditions.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and requirements of SDI, ANSI/NFPA 80, BHMA, DHI, NAMM and AWI.

B. Use the templates provided by hardware item manufacturer.

C. Conform to ANSI A117.1 for positioning requirements for the handicapped.

3.03 SCHEDULE

A. Each door shall receive the hardware as noted on Drawings, as herein specified or as required by applicable codes. Provide exterior grade and fire rated grade as required.

B. HARDWARE SET:1 (EXISTING DOUBLE DOOR WITH PANIC HARDWARE AND AUTO OPERATOR)

3 PR	HEAVY DUTY HINGE	BB1168	US26D	HAGER
2 EA	POWER TRANSFER	EPT 10 689		VON DUPRIN
2 EA	FIRE ELEC PANIC HDWE	QEL-9827-L-F	626	VON DUPRIN
2 EA	CYLINDER	CYLINDER TO MATCH STANDARD ON THIS CAMPUS		
2 EA	LEVER TRIM	MATCH EXISTING FINISH, STYLE, MFG.		
2 EA	AUTO OPERATOR	ED-700	AL	DORMA
4 EA	ACTUATOR	BEA-PBS1	630	BEA
2 EA	POWER SUPPLY	PS904 900-2RD LGR		VON DUPRIN

VERIFY MOUNTING LOCATION OF ACTUATOR. CONFIRM WHETHER BOLLARD IS REQUIRED. CONFIRM WHETHER HARD-WIRED OR WIRELESS ACTUATOR IS REQUIRED.

EXIT DEVICE SHALL BE CAPABLE OF FIELD MODIFICATION TO LESS BOTTOM ROD.

OPERATIONAL DESCRIPTION
DOOR NORMALLY CLOSED AND UNLOCKED. MECHANICAL ENTRY BY KEY WHEN DOOR IS LOCKED. FREE EGRESS BY INSIDE PUSH BAR.
LATCH RETRACTION AND AUTOMATIC OPERATION BY PUSH BUTTON AT INTERIOR OR EXTERIOR SIDE OF DOOR. COORDINATE WIRING OF BUTTON SO IT IS ONLY ENABLED WHEN DOOR IS UNLOCKED.

C. HARDWARE SET:2 (REINSTALLED FRAME & DOUBLE DOOR WITH PANIC HARDWARE)

FIRE PANIC HARDWARE	9827-L-NL-F	626	VON DUPRIN
LEVER TRIM	MATCH EXISTING FINISH, STYLE, MFG		
CYLINDER	CYLINDER TO MATCH STANDARD ON THIS CAMPUS.		

EXIT DEVICE SHALL BE CAPABLE OF FIELD MODIFICATION TO LESS BOTTOM ROD.

OPERATIONAL DESCRIPTION
DOOR NORMALLY CLOSED AND UNLOCKED. MECHANICAL ENTRY BY KEY WHEN DOOR IS LOCKED. FREE EGRESS BY INSIDE PUSH BAR.
.

END OF SECTION 08 71 00

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SECTION 09 91 00
PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Surface finish schedule.

1.02 REFERENCES

A. ANSI/ASTM D16 - Definitions of Terms Relating to Paint, Varnish, Lacquer and Related Products.

B. ASTM D2016 - Test Method for Moisture Content of Wood.

1.03 DEFINITIONS

A. Conform to ANSI/ASTM D16 for interpretation of terms used in this Section.

1.04 QUALITY ASSURANCE

A. PRODUCT MANUFACTURER: Company specializing in manufacturing quality paint and finish products with 20 years experience.

B. APPLICATOR: Company specializing in commercial painting and finishing with 10 years documented experience.

1.05 REGULATORY REQUIREMENTS

A. Conform to applicable code for flame/fuel/smoke rating requirements for finishes.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees F for 24 hours before, during and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is above 50 percent unless allowed or required otherwise by manufacturer's instructions.

C. MINIMUM APPLICATION TEMPERATURES FOR LATEX PAINTS: 45 degrees F for interiors; 50 degrees F for exterior; unless allowed or required otherwise by manufacturer's instructions.

D. MINIMUM APPLICATION TEMPERATURE FOR VARNISH AND URETHANE FINISHES: 65 degrees F for interior or exterior, unless allowed or required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.07 SUBMITTALS

A. Submit product data under provisions of Section 01 33 00.

B. Provide product data on all finishing products and special coatings.

C. Submit samples under provisions of Section 01 33 00.

D. Submit two samples 1 x 1 inch in size illustrating range of colors and textures available for each surface finishing product scheduled, for selection.

E. Submit manufacturer's application instructions under provisions of Section 01 33 00.

1.08 FIELD SAMPLES

A. Provide samples under provisions of Section 01 33 00.

B. Provide one field sample panel for each type of coating, 4 feet square, illustrating coating color, texture and finish.

C. Locate where directed by Architect.

D. Accepted sample may not remain as part of the Work.

1.09 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site under provisions of Section 01 60 00.

B. Store and protect products under provisions of Section 01 60 00.

C. Deliver products to site in sealed and labeled containers; inspect to verify acceptance.

D. Container labeling to include manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation and instructions for mixing and reducing.

E. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in well ventilated area, unless required otherwise by manufacturer's instructions.

F. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.10 EXTRA STOCK

A. Provide a five gallon container of each color and surface texture to Owner.

B. Label each container with color, texture and room locations, in addition to the manufacturer's label.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Except as otherwise specified, materials shall be the first line products of the following manufacturers:
   1. Benjamin Moore.
   2. Pittsburgh Paints.
   3. Sherwin Williams.

   4. H&C Concrete Stains and Sealers

B. Materials selected for coating systems for each type surface shall be the product of a single manufacturer.

2.02 MATERIALS

A. Products specified are as manufactured by paint companies identified with manufacturers listed in Paragraph 2.01.

B. Select primary products of the coating system from the products of a single manufacturer.

C. Secondary products not specified by name and required for the job, such as shellac, thinners, putty, shall be "best grade" or "first line" products of a reputable manufacturer.

D. COATINGS
1. Ready mixed, except field catalyzed coatings; tile-like gloss finish.
2. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating.
3. Good flow and brushing properties; capable of drying or curing free of streaks or sags.

E. ACCESSORY MATERIALS: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

2.03 FINISHES

A. Refer to schedule at end of Section for surface finish schedule.

B. In addition to the finish systems specified in the painting schedule, materials shall be lead-free.

2.04 TINTING AND MIXING

A. Job mixing or tinting may be done only when approved by the Architect.

2.05 COLORS AND PATTERNS

A. Colors shall be as selected by the Architect from the manufacturer’s standard range of colors.

B. The Architect reserves the right to select, allocate and vary colors on different surfaces throughout the building.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify that surfaces or substrate conditions are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. GYPSUM WALLBOARD: 12percent.
2. CONCRETE UNIT MASONRY: 12 percent.
3. INTERIOR LOCATED WOOD: 15 percent, measured in accordance with ASTM D2016.

D. Beginning of installation means acceptance of surfaces or substrate.

3.02 PREPARATION

A. Remove electrical plates, hardware, light fixtures trim and fittings prior to preparing surfaces or finishing.

B. Correct minor defects and clean surfaces which affect work of this Section.

C. Shellac and seal marks which may bleed through surface finishes.

D. IMPERVIOUS SURFACES: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

E. ASPHALT OR BITUMINOUS SURFACES SCHEDULED FOR PAINT FINISH: Remove foreign particles to permit adhesion of finishing materials. Apply compatible sealer or primer

F. GYPSUM BOARD SURFACES: Latex fill minor defects. Spot prime defects after repair

G. GALVANIZED SURFACES: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

H. UNIT MASONRY SURFACES SCHEDULED TO RECEIVE PAINT FINISH: Remove dirt, peeling paint, loose mortar, scale, salt or alkali powder and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

I. UNCOATED STEEL AND IRON SURFACES: Remove grease, scale, dirt and rust. Where heavy coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts and nuts are similarly cleaned. Spot prime paint after repairs

J. SHOP PRIMED STEEL SURFACES: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

3.03 PROTECTION

A. Protect elements surrounding the work of this Section from damage or disfiguration.

B. Repair damage to other surfaces caused by work of this Section.

C. Furnish drop cloths, shields, and protective methods to prevent spray or droppings from disfiguring other surfaces.

D. Remove empty paint containers from site.

3.04 APPLICATION

A. Apply products in accordance with manufacturer's instructions.

B. Do not apply finishes to surfaces that are not dry.

C. Apply each coat to uniform finish.

D. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.

E. Sand lightly between coats to achieve required finish.

F. Allow applied coat to dry before next coat is applied.

G. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

H. Prime back surfaces of interior and exterior woodwork with primer paint.

I. Prime back surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.

3.05 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Paint shop primed equipment.

B. Remove unfinished louvers, grilles, covers and access panels on mechanical and electrical components and paint separately.

C. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports except where items are prefinished.

D. Replace identification markings on mechanical or electrical equipment when painted accidentally.

E. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint, to limit of sight line. Paint dampers exposed behind louvers, grilles and convector and baseboard cabinets to match face panels.

F. Paint exposed conduit and electrical equipment occurring in finished areas.

G. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

H. Replace electrical plates, hardware, light fixture trim and fittings removed prior to finishing.

3.06 CLEANING

A. As Work proceeds, promptly remove paint where spilled, splashed or spattered.

B. During progress of Work maintain premises free of unnecessary accumulation of tools, equipment, surplus materials and debris.

C. Collect cotton waste, cloths and material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

D. Touch up and restore finish where damaged. Do not mar surface finish of item being cleaned.

E. Leave storage space clean and in condition required for equivalent spaces in project.

3.07 SCHEDULE - SHOP PRIMED ITEMS FOR SITE FINISHING

A. Section 05 50 00 - Metal Fabrications: Exposed surfaces of lintels.

2ND FINISH COAT:	Latex Semi-gloss

3.08 SCHEDULE - INTERIOR SURFACES

A. STEEL – PRIMED

PRIME COAT:	Prime with Acrylic Latex primer.
1ST FINISH COAT:	Alkyd Gloss Enamel

2ND FINISH COAT: Alkyd Gloss Enamel

END OF SECTION 09 91 00

SECTION 230519
METERS AND GAUGES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flow meters.

B. Pressure gauges and pressure gauge taps.

C. Thermometers and thermometer wells.

D. Static pressure gauges.

1.02 RELATED REQUIREMENTS

A. Section 230923 - Direct-Digital Control System for HVAC.

B. Section 230993 - Sequence of Operations for HVAC Controls.

C. Section 232113 - Hydronic Piping.

1.03 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments 2013.

B. ASME MFC-3M - Measurement of Fluid Flow in Pipes Using Orifice, Nozzle and Venturi 2004 (Reaffirmed 2017).

C. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers 2014.

D. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers 2014, with Editorial Revision (2017).

E. AWWA C700 - Cold-Water Meters -- Displacement Type, Metal Alloy Main Case 2015.

F. AWWA C701 - Cold-Water Meters -- Turbine Type, for Customer Service 2015.

G. AWWA C702 - Cold-Water Meters -- Compound Type 2015.

H. AWWA M6 - Water Meters -- Selection, Installation, Testing, and Maintenance 2012, with Addendum (2018).

I. UL 393 - Indicating Pressure Gauges for Fire-Protection Service Current Edition, Including All Revisions.

J. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Samples: Submit two of each type of instrument specified.

C. Project Record Documents: Record actual locations of components and instrumentation.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Gauge Oil for Inclined Manometers: One bottle.
3. Extra Pressure Gauges: One of each type and size.

1.05 **FIELD CONDITIONS**

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.01 **LIQUID FLOW METERS**

A. Calibrated ASME MFC-3M Venturi orifice plate and flanges with valved taps, chart for conversion of differential pressure readings to flow rate, with pressure gauge in case.

B. Annular element flow stations with meter set.

1. Measuring Station: Type 316 stainless steel pitot type flow element inserted through welded threaded couplet, with safety shut-off valves and quick coupling connections, and permanent metal tag indicating design flow rate, reading for design flow rate, metered fluid, line size, station or location number.

a. Pressure rating: 275 psi (1896 kPa).

b. Maximum temperature: 400 degrees F (204 degrees C).

c. Accuracy: Plus, 0.55 percent to minus 2.30 percent.

2. Portable Meter Set: Dry single diaphragm type pressure gauge with 6 inch (150 mm) dial pointer, stainless steel wetted metal parts, variable pulsation damper, equalizing valve, two bleed valves, and master chart for direct conversion of meter readings to flow rate, mounted in rust-proof carrying case with two ten foot (3 m) long rubber test hoses with brass valves or quick connections for measuring stations.

2.02 **PRESSURE GAUGES**

A. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.

1. Case: Steel with brass bourdon tube.

2. Size: 4-1/2-inch (115 mm) diameter.

3. Mid-Scale Accuracy: One percent.

4. Scale: Psi and KPa.

2.03 **PRESSURE GAUGE TAPPINGS**

A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi (1034 kPa).

B. Needle Valve: Brass, 1/4-inch (6 mm) NPT for minimum 150 psi (1034 kPa).

C. Pulsation Damper: Pressure snubber, brass with 1/4-inch (6 mm) connections.

D. Syphon: Steel, Schedule 40, 1/4-inch (6 mm) angle or straight pattern.

2.04 **STEM TYPE THERMOMETERS**

A. Thermometers - Fixed Mounting: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish.

1. Size: 9-inch (225 mm) scale.

2. Window: Clear Lexan.

3. Accuracy: 2 percent, per ASTM E77.

4. Calibration: Degrees F.

B. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.

1. Size: 9-inch (225 mm) scale.
2. Window: Clear Lexan.
3. Stem: 3/4-inch (20 mm) NPT brass.
4. Accuracy: 2 percent, per ASTM E77.
5. Calibration: Degrees F.

2.05 DIAL THERMOMETERS

A. Thermometers - Fixed Mounting: Dial type bimetallic actuated; ASTM E1; stainless steel case, silicone fluid damping, white with black markings and black pointer, hermetically sealed lens, stainless steel stem.

1. Size: 5-inch (125 mm) diameter dial.
2. Lens: Clear glass.
3. Accuracy: 1 percent.
4. Calibration: Degrees F.

B. Thermometer: ASTM E1, stainless steel case, adjustable angle with front recalibration, bimetallic helix actuated with silicone fluid damping, white with black markings and black pointer hermetically sealed lens, stainless steel stem.

1. Size: 3-inch (75 mm) diameter dial.
2. Lens: Clear glass.
3. Accuracy: 1 percent.
4. Calibration: Degrees F.

C. Thermometers: Dial type vapor or liquid actuated; ASTM E1; stainless steel case, with brass or copper bulb, copper or bronze braided capillary, white with black markings and black pointer, glass lens.

1. Size: 4-1/2-inch (115 mm) diameter dial.
2. Lens: Clear glass.
3. Length of Capillary: Minimum 5 feet (1500 mm).
4. Accuracy: 2 percent.
5. Calibration: Degrees F.

2.06 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

B. Flange: 3 inch (75 mm) outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.07 **TEST PLUGS**

A. Test Plug: 1/4-inch (6 mm) or 1/2-inch (13 mm) brass fitting and cap for receiving 1/8 inch (3 mm) outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F (93 degrees C).

B. Test Plug: 1/4-inch (6 mm) or 1/2-inch (13 mm) brass fitting and cap for receiving 1/8 inch (3 mm) outside diameter pressure or temperature probe with Nordel core for temperatures up to 350 degrees F (176 degrees C).

C. Test Plug: 1/4-inch (6 mm) or 1/2-inch (13 mm) brass fitting and cap for receiving 1/8 inch (3 mm) outside diameter pressure or temperature probe with Viton core for temperatures up to 400 degrees F (204 degrees C).

D. Test Kit: Carrying case, internally padded and fitted containing one 2-1/2-inch (60 mm) diameter pressure gauges, one-gauge adapters with 1/8-inch (3 mm) probes, two 1-inch (25 mm) dial thermometers.

2.08 **STATIC PRESSURE GAUGES**

A. 3-1/2-inch (90 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, 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.

PART 3 EXECUTION

3.01 **INSTALLATION**

A. Install in accordance with manufacturer's instructions.

B. Install positive displacement meters with isolating valves on inlet and outlet to AWWA M6. Provide full line size valved bypass with globe valve for liquid service meters.

C. Provide one pressure gauge per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gauge.

D. Install pressure gauges with pulsation dampers. Provide gauge cock to isolate each gauge. Provide siphon on gauges in steam systems. Extend nipples and siphons to allow clearance from insulation.

E. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch (60 mm) for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

F. Install thermometers in air duct systems on flanges.

G. Install thermometer sockets adjacent to controls system thermostat, transmitter, or sensor sockets. Refer to Section 230943. Where thermometers are provided on local panels, duct or pipe mounted thermometers are not required.

H. Locate duct mounted thermometers minimum 10 feet (3 m) downstream of mixing dampers, coils, or other devices causing air turbulence.

I. Coil and conceal excess capillary on remote element instruments.

J. Provide instruments with scale ranges selected according to service with largest appropriate scale.

K. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

L. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

M. Locate test plugs adjacent thermometers and thermometer sockets.

3.02 **SCHEDULE**

A. Positive Displacement Meters, Location:

1. Expansion tank make-up.
2. Cooling tower make-up.

B. Flow Meters, Location:

1. Heating water system.
2. Chilled water system.

C. Pressure Gauges, Location and Scale Range shall be 150% of system pressure for the following:

1. Pumps
2. Expansion tanks
3. Pressure tanks
4. Standpipe, highest points
5. Standpipe and sprinkler water supply connection
6. Pressure reducing valves
7. Backflow preventers

D. Pressure Gauge Tappings, Location:

1. Control valves 3/4 inch (20 mm) & larger - inlets and outlets.
2. Chiller - inlets and outlets.
3. Boiler - inlets and outlets.

E. Stem Type Thermometers, Location and Scale Range shall be up to 150% of system operating temperature

1. Headers to central equipment
2. Boilers - inlets and outlets
3. Chiller - inlets and outlets
4. Domestic hot water supply and recirculation

F. Thermometer Sockets, Location:

1. Control valves 1 inch (25 mm) & larger - inlets and outlets.

G. Dial Thermometers, Location and Scale Range shall be up to 150% of system operating temperature

1. Outside air

H. Static Pressure and Filter Gauges, Location and Scale Range shall be up to 150% of system operating pressure

1. Supply fan discharge
2. Building static

END OF SECTION

SECTION 230523
GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Applications.

B. General requirements.

C. Angle valves.

D. Globe valves.

E. Ball valves.

F. Butterfly valves.

G. Check valves.

H. Gate valves.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 083100 - Access Doors and Panels.

C. Section 230548 - Vibration and Seismic Controls for HVAC.

D. Section 230553 - Identification for HVAC Piping and Equipment.

E. Section 230716 - HVAC Equipment Insulation.

F. Section 230719 - HVAC Piping Insulation.

G. Section 232113 - Hydronic Piping.

1.03 REFERENCE STANDARDS

A. API STD 594 - Check Valves: Flanged, Lug Wafer, and Butt-Welding 2017.

B. ASME B1.20.1 - Pipe Threads, General Purpose (Inch) 2013 (Reaffirmed 2018).

C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250 2015.

D. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard 2017.

E. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves 2017.

F. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2018.

G. ASME B16.34 - Valves - Flanged, Threaded and Welding End 2017.

H. ASME B31.1 - Power Piping 2018.

I. ASME B31.9 - Building Services Piping 2017.

J. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazing; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications 2019.

K. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings 2004 (Reapproved 2019).

L. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures 1999 (Reapproved 2018).

M. ASTM A536 - Standard Specification for Ductile Iron Castings 1984 (Reapproved 2014).

N. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings 2017.

O. AWWA C606 - Grooved and Shouldered Joints 2015.

P. MSS SP-67 - Butterfly Valves 2017.

Q. MSS SP-68 - High Pressure Butterfly Valves with Offset Design 2017.

R. MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends 2011.

S. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends 2018.

T. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service 2010a.

U. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves 2013.

V. MSS SP-85 - Cast Iron Globe & Angle Valves, Flanged and Threaded Ends 2011.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

E. Maintenance Materials: Furnish Owner with one wrench for every five plug valves, in each size of square plug valve head.

1. See Section 016000 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

1.06 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
2. Protect valve parts exposed to piped medium against rust and corrosion.
3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.
5. Secure check valves in either the closed position or open position.
6. Adjust butterfly valves to closed or partially closed position.

B. Use the following precautions during storage:

1. Maintain valve end protection and protect flanges and specialties from dirt.
   a. Provide temporary inlet and outlet caps.
   b. Maintain caps in place until installation.

2. Store valves in shipping containers and maintain in place until installation.
   a. Store valves indoors in dry environment.
   b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

C. Exercise the following precautions for handling:
   1. Handle large valves with sling, modified to avoid damage to exposed parts.
   2. Avoid the use of operating handles or stems as rigging or lifting points.

PART 2 PRODUCTS

2.01 **APPLICATIONS**

A. Provide the following valves for the applications if not indicated on drawings:
   1. Throttling (Hydronic): Butterfly, Ball, Globe, Angle.
   2. Isolation (Shutoff): Butterfly, Gate, Ball, Plug.
   3. Swing Check (Pump Outlet):
      a. 2 NPS (50 DN) and Smaller: Bronze with bronze disc.
      b. 2-1/2 NPS (65 DN) and Larger: Iron with lever and weight, lever and spring, center-guided metal, center-guided with resilient seat.
   4. Dead-End: Butterfly, single-flange (lug) type.

B. Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.

C. Required Valve End Connections for Non-Wafer Types:
   1. Steel Pipe:
      a. 2 NPS (50 DN) and Smaller: Threaded ends.
      b. 2-1/2 NPS (65 DN) and Larger: Grooved ends.
   2. Copper Tube:
      a. 2 NPS (50 DN) and Smaller: Threaded ends (Exception: Solder-joint valve-ends).
      b. 2-1/2 NPS (65 DN) and Larger: Grooved ends.

D. Chilled Water Valves:
   1. 2 NPS (50 DN) and Smaller, Brass, Bronze Valves:
      a. Threaded ends.
      b. Angle: Bronze disc, Class 125.
      c. Ball: Full port, one-piece, brass trim.
      d. Swing Check: Bronze disc, Class.
      e. Gate: NRS, Class 125.
      f. Globe: Bronze disc, Class 125.
   2. 2-1/2 NPS (65 DN) and Larger, Iron Valves:
      a. 2-1/2 NPS (65 DN) to 4 NPS (100 DN): Threaded ends.

b. Ball: 2-1/2 NPS (65 DN) to 10 NPS (250 DN), Class 150.

c. Single-Flange Butterfly: 2-1/2 NPS (65 DN) to 12 NPS (300 DN), aluminum-bronze disc, EPDM seat, 200 CWP.

d. Grooved-End Butterfly: 2-1/2 NPS (65 DIN) to 12 NPS (300 DN), 175 CWP.

e. Butterfly: High performance, single flange, Class 150.

f. Swing Check: Metal seats, Class 125.

g. Swing Check with Closure Control: 2-1/2 NPS (65 DN) to 12 NPS (300 DN), lever and spring, Class 125.

h. Grooved-End Check: 3 NPS (80 DN) to 12 NPS (300 DN), 300 CWP.

E. Condenser Water Valves:

1. 2 NPS (50 DN) and Smaller, Brass, Bronze Valves:

a. Threaded ends.

b. Angle: Bronze disc, Class 125.

c. Ball: Full port, one-piece, brass trim.

d. Swing Check: Bronze disc, Class 125.

e. Gate: NRS, Class 125.

f. Globe: Bronze disc, Class 125.

2. 2-1/2 NPS (65 DIN) and Larger, Iron Valves:

a. 2-1/2 NPS (65 DN) to 4 NPS (100 DN): Threaded ends.

b. Ball: 2-1/2 NPS (65 DN) to 10 NPS (250 DN), Class 150.

c. Single-Flange Butterfly: 2-1/2 NPS (65 DN) to 12 NPS (300 DN), aluminum-bronze disc, EPDM seat, 200 CWP.

d. Grooved-End Butterfly: 2-1/2 NPS (65 DN) to 12 NPS (300 DN), 175 CWP.

e. Butterfly: High performance, single flange, Class 150.

f. Swing Check: Metal seats, Class 125.

F. Heating Hot Water Valves:

1. 2 NPS (50 DN) and Smaller, Brass, Bronze Valves:

a. Threaded ends.

b. Angle: Bronze disc, Class 125.

c. Ball: Full port, one-piece, brass trim.

d. Swing Check: Bronze disc, Class 125.

e. Gate: NRS, Class 125.

f. Globe: Bronze disc, Class 125.

2. 2-1/2 NPS (65 DN) and Larger, Iron Valves:

a. 2-1/2 NPS (65 DN) to 4 NPS (100 DN): Threaded ends.

b. Ball: 2-1/2 NPS (65 DN) to 10 NPS (250 DN), Class 150.

c. Single-Flange Butterfly: 2-1/2 NPS (65 DN) to 12 NPS (300 DN), aluminum-bronze disc, EPDM seat, 200 CWP.

d. Single-Flange Butterfly: 14 NPS (350 DN) to 24 NPS (600 DN), aluminum-bronze disc, EPDM seat, 150 CWP.

e. Grooved-End Butterfly: 2-1/2 NPS (65 DN) to 12 NPS (300 DN), 175 CWP.

f. Butterfly: High performance, single flange, Class 150.

g. Swing Check: Metal seats, Class 125.

h. Swing Check: 2-1/2 NPS (65 DN) to 12 NPS (300 DN), lever and spring closure control, Class 125.

i. Grooved-End Swing Check: 3 NPS (80 DN) to 12 NPS (300 DN), 300 CWP.

j. Center-Guided Check: Compact-wafer, metal seat, Class 125.

k. Plate-Type Check: Single plate, metal seat, Class 125 .

l. Gate: NRS, Class 125.

m. Globe: 2-1/2 NPS (65 DN) to 12 NPS (300 DN), Class 125.

2.02 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:

1. Gear Actuator: Quarter-turn valves 8 NPS (200 DN) and larger.
2. Handwheel: Valves other than quarter-turn types.
3. Hand Lever: Quarter-turn valves 6 NPS (150 DN) and smaller.
4. Wrench: Plug valves with square heads.
5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator, of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

D. Valves in Insulated Piping: Provide 2 NPS (50 DN) stem extensions and the following features:

1. Gate Valves: Rising stem.
2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: Extended neck.
4. Memory Stops: Fully adjustable after insulation is installed.

E. Memory Stops: Fully adjustable after insulation is installed.

F. Valve-End Connections:

1. Threaded End Valves: ASME B1.20.1.
2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
3. Pipe Flanges and Flanged Fittings 1/2 NPS (15 DN) through 24 NPS (600 DN): ASME B16.5.

4. Solder Joint Connections: ASME B16.18.
5. Grooved End Connections: AWWA C606.

G. General ASME Compliance:

1. Building Services Piping Valves: ASME B31.9.

2.03 **BRONZE ANGLE VALVES**

A. Class 125: CWP Rating: 200 psig: (1380 kPa) and Class 150: CWP Rating: 300 psig: (2070 kPa).

1. Comply with MSS SP-80, Type 1.
2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
3. Ends: Threaded.
4. Stem: Bronze.
5. Disc: Bronze, PTFE or TFE.
6. Packing: Asbestos free.
7. Handwheel: Bronze or aluminum.

2.04 **BRONZE GLOBE VALVES**

A. Class 125: CWP Rating: 200 psig: (1380 kPa).

1. Comply with MSS SP-80, Type 1.
2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
3. Ends: Threaded or solder joint.
4. Stem and Disc: Bronze, PTFE.
5. Packing: Asbestos free.
   a. Handwheel: Malleable iron.

2.05 **IRON GLOBE VALVES**

A. Class 125: CWP Rating: 200 psig: (1380 kPa) and Class 250: CWP Rating: 500 psig: (3450 kPa).

1. Comply with MSS SP-85, Type I.
2. Body: Gray iron; ASTM A126, with bolted bonnet.
3. Ends: Flanged.
4. Trim: Bronze.
5. Packing and Gasket: Asbestos free.
6. Operator: Handwheel or chainwheel.

2.06 **IRON BALL VALVES**

A. Split Body, Full Port:

1. Comply with MSS SP-72.
2. CWP Rating: 200 psig (1380 kPa).
3. Body: ASTM A126, gray iron.
4. Ends: Flanged.

5. Seats: PTFE.
6. Stem: Stainless steel.
7. Ball: Stainless steel.

2.07 **IRON, SINGLE FLANGE BUTTERFLY VALVES**

A. Lug type: Bi-directional dead-end service without downstream flange.

1. Comply with MSS SP-67, Type I.
2. CWP Rating: 150 psig
3. Body Material: ASTM A126 cast iron, ASTM A536 ductile iron.
4. Stem: One or two-piece stainless steel.
5. Seat: NBR.
6. Disc: Coated ductile iron.

2.08 **IRON, GROOVED-END BUTTERFLY VALVES**

A. CWP Rating: 175 psig (1200 kPa), 300 psig (2070 kPa): 8 NPS (50 DN) or smaller, 200 psig (1389 kPa): 10 NPS (250 DN) or larger.

1. Comply with MSS SP-67, Type I.
2. Body: Coated ductile iron.
3. Stem: Stainless steel.
4. Disc: Coated ductile iron.
5. Disc Seal: EPDM.

2.09 **HIGH-PERFORMANCE SINGLE FLANGE BUTTERFLY VALVES**

A. Lug type: Bi-directional dead-end service without downstream flange.

1. Comply with MSS SP-68.
2. Class 150: CWP Rating: 285 psig (1965 kPa), Class 300: CWP Rating: 720 psig (4965 kPa) at 100 degrees F (38 degrees C).
3. Body: Provide carbon steel, cast iron, ductile Iron, stainless steel.
4. Seat: Metal or reinforced PTFE.
5. Offset stem: Stainless steel.
6. Disc: Carbon steel.

2.10 **BRONZE SWING CHECK VALVES**

A. Class 125: CWP Rating: 200 psig (1380 kPa), Class 150: CWP Rating: 300 psig (2070 kPa).

1. Comply with MSS SP-80, Type 3.
2. Body Design: Horizontal flow.
3. Body Material: Bronze, ASTM B62.
4. Ends: Threaded.
5. Disc: Bronze.

2.11 **IRON, FLANGED END SWING CHECK VALVES**

A. Class 125: CWP Rating: 200 psig (1380 kPa) with Metal Seats, Class 125: CWP Rating: 150 psig (1035 kPa) with Metal Seats, Class 250: CWP Rating: 500 psig (3450 kPa) with Metal Seats, Class 250: CWP Rating: 300 psig (2070 kPa) with Metal Seats, Class 125: CWP Rating: 200 psig (1380 kPa) with Nonmetallic-to-Metal Seats.

1. Comply with MSS SP-71, Type I.
2. Design: Clear or full waterway with flanged ends.
3. Body: Gray iron with bolted bonnet in accordance with ASTM A126.
4. Trim: Bronze.
5. Disc Holder: Bronze.
6. Disc: PTFE, TFE
7. Gasket: Asbestos free.

2.12 **IRON SWING CHECK VALVES WITH CLOSURE CONTROL**

2.13 **IRON, GROOVED-END SWING CHECK VALVES**

A. 300 CWP:

1. 10 NPS (250 DN) to 12 NPS (300 DN).
2. CWP Rating: 300 psig (2070 kPa).
3. Body Material: ASTM A536, Grade 65-45-12 ductile iron.
4. Seal: EPDM, Nitrile or [____].
5. Disc: Ductile iron.
6. Coating: Black, non-lead paint.

2.14 **IRON, CENTER-GUIDED CHECK VALVES**

2.15 **IRON, PLATE-TYPE CHECK VALVES**

2.16 **BRONZE GATE VALVES**

A. Non-Rising Stem (NRS), Rising Stem (RS) :

1. Comply with MSS SP-80, Type I.
2. Body Material: Bronze with integral seat and union-ring bonnet.
3. Ends: Threaded or solder joint.
4. Stem: Bronze.
5. Disc: Solid wedge; bronze.
6. Packing: Asbestos free.
7. Handwheel: Malleable iron, bronze, or aluminum.

2.17 **IRON GATE VALVES**

A. NRS, OS & Y:

1. Comply with MSS SP-70, Type I.
2. Body Material: Gray iron with bolted bonnet.

3. Ends: Flanged.
4. Trim: Bronze.
5. Disc: Solid wedge.
6. Packing and Gasket: Asbestos free.

END OF SECTION

SECTION 230529
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General - Purpose Piping 2014.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.

E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2018).

F. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2019b.

H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.

I. MFMA-4 - Metal Framing Standards Publication 2004.

J. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018.

K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.

2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.

3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 1.25. Include consideration for vibration, equipment operation, and shock loads where applicable.

4. Steel Components: Use corrosion resistant materials suitable for the environment where installed.

   a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.

   b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.

1. Comply with MFMA-4.

C. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

1. Minimum Size, Unless Otherwise Indicated or Required:

a. Equipment Supports: 1/2-inch diameter.

b. Piping up to 1-inch nominal: 1/4-inch diameter.

c. Piping larger than 1-inch nominal: 3/8-inch diameter.

d. Trapeze Support for Multiple Pipes: 3/8-inch diameter.

D. Thermal Insulated Pipe Supports:

1. General Construction and Requirements:

a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.

c. Pipe supports to be provided for nominally sized, 1/2 inch to 30-inch iron pipes.

d. Insulation inserts to consist of rigid polyisocyanurate (urethane) insulation surrounded by a 360-degree, PVC jacketing.

2. PVC Jacket:

a. Pipe insulation protection shields to be provided with a ball bearing hinge and locking seam.

b. Moisture Vapor Transmission: 0.0071 per inch, when tested in accordance with ASTM E96/E96M.

c. Thickness: 60 mil (1.524 mm).

E. Pipe Supports:

1. Liquid Temperatures Up To 122 degrees F (50 degrees C):

a. Overhead Support: MSS SP-58 Types 1, 3 through 12.

b. Support From Below: MSS SP-58 Types 35 through 38.

2. Operating Temperatures from 122 to 446 degrees F (50 to 230 degrees C):

a. Overhead Support: MSS SP-58 Type 1 or 3 through 12, with appropriate saddle of MSS SP-58 Type 40 for insulated pipe.

b. Roller Support: MSS SP-58 Types 41 or 43 through 46, with appropriate saddle of MSS SP-58 Type 39 for insulated pipe.

c. Sliding Support: MSS SP-58 Types 35 through 38.

F. Beam Clamps: MSS SP-58 Types 19 through 23, 25 or 27 through 30 based on required load.

1. Material: ASTM A36/A36M carbon steel or ASTM A181/A181M forged steel.

2. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.

G. Riser Clamps:

1. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.

H. Offset Pipe Clamps: Double-leg design two-piece pipe clamp.

I. Strut Clamps: Two-piece pipe clamp.

1. Manufacturers:

a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

J. Insulation Clamps: Two bolt-type clamps designed for installation under insulation.

1. Manufacturers:

a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

K. Pipe Hangers: For a given pipe run use hangers of the same type and material.

1. Manufacturers:

2. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.

3. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

L. Anchors and Fasteners:

1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

PART 3 EXECUTION

3.01 **INSTALLATION**

A. Install products in accordance with manufacturer's instructions.

B. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

C. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

D. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

F. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

G. Equipment Support and Attachment:

1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.

2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.

3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.

4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Secure fasteners according to manufacturer's recommended torque settings.

I. Remove temporary supports.

END OF SECTION

SECTION 230548
VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration isolation requirements.

B. Vibration-isolated equipment support bases.

C. Vibration isolators.

1.02 RELATED REQUIREMENTS

A. Section 014533 - Code-Required Special Inspections and Procedures.

B. Section 033000 - Cast-in-Place Concrete.

C. Section 055000 - Metal Fabrications: Materials and requirements for fabricated metal supports.

D. Section 220548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

E. Section 230529 - Hangers and Supports for HVAC Piping and Equipment.

1.03 REFERENCE STANDARDS

A. ASHRAE (HVAC) - ASHRAE Handbook - HVAC Applications Most Recent Edition Cited by Referring Code or Reference Standard.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.

1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification method for spring element load capacities.

2. Seismic Controls: Include seismic load capacities.

D. Shop Drawings - Vibration Isolation Systems:

1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.

2. Vibration-Isolated Equipment Support Bases: Include base weights, including concrete fill where applicable; indicate equipment mounting provisions.

E. Shop Drawings - Seismic Controls:

1. Include dimensioned plan views and sections indicating proposed HVAC component locations and distributed system routing, with locations and details of gravity supports and seismic restraints and associated attachments.

2. Identify anchor manufacturer, type, minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.

3. Indicate proposed arrangement of distributed system trapeze support groupings.

4. Indicate proposed locations for distributed system flexible fittings and/or connections.
5. Indicate locations of seismic separations where applicable.

F. Manufacturer's detailed field testing and inspection procedures.

PART 2 PRODUCTS

2.01 **VIBRATION ISOLATION REQUIREMENTS**

A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing HVAC equipment and/or HVAC connections to vibration-isolated equipment.

B. Comply with applicable general recommendations of ASHRAE (HVAC), where not in conflict with other specified requirements:

C. General Requirements:

1. Select vibration isolators to provide required static deflection.
2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.

2.02 **VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES**

A. Manufacturers:

1. Vibration-Isolated Equipment Support Bases:
   a. Kinetics Noise Control, Inc; www.kineticsnoise.com/#sle.
   b. Mason Industries; www.mason-ind.com/#sle.
   c. Vibration Eliminator Company, Inc; www.veco-nyc.com/#sle.

2.03 **VIBRATION ISOLATORS**

A. Manufacturers:

1. Vibration Isolators:
2. Source Limitations: Furnish vibration-isolators and associated accessories produced by a single manufacturer and obtained from a single supplier.

B. General Requirements:

1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
2. Spring Elements for Spring Isolators:
   a. Color code or otherwise identify springs to indicate load capacity.
   b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
   c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
   d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
   e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
   f. Selected to function without undue stress or overloading.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

E. Vibration Isolation Systems:

1. Vibration-Isolated Equipment Support Bases:
   a. Provide specified minimum clearance beneath base.
2. Spring Isolators:
   a. Position equipment at operating height; provide temporary blocking as required.
   b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
   c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
3. Isolator Hangers:
   a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
   b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
4. Thrust Restraints:
   a. Adjust restraint movement under normal operating static pressure.
5. Clean debris from beneath vibration-isolated equipment that could cause short circuiting of isolation.
6. Use elastomeric grommets for attachments where required to prevent short circuiting of isolation.
7. Adjust isolators to be free of isolation short circuits during normal operation.
8. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

3.02 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect vibration isolation and/or seismic control components for damage and defects.

C. Provide manufacturer representative or authorized technician services to assist with inspection and testing of vibration isolation systems and seismic controls. Submit a detailed copy of manufacturer recommended inspection, testing and field report procedures.

D. Vibration Isolation Systems:

1. Verify isolator static deflections.

2. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.

E. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

3.03 **ATTACHMENTS**

A. Statement of special inspections.

END OF SECTION

SECTION 230553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Adhesive-backed duct markers.

D. Stencils.

E. Pipe markers.

F. Ceiling tacks.

1.02 RELATED REQUIREMENTS

A. Section 099123 - Interior Painting: Identification painting.

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems 2015.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials 2017.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Automatic Controls: Tags. Key to control schematic.

B. Control Panels: Nameplates.

C. Dampers: Ceiling tacks, where located above lay-in ceiling.

D. Ductwork: Nameplates.

E. Instrumentation: Tags.

F. Major Control Components: Nameplates.

G. Piping: Tags.

H. Thermostats: Nameplates.

I. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.02 NAMEPLATES

A. Letter Color: White.

B. Letter Height: 1/4 inch (6 mm).

C. Background Color: Black.

D. Plastic: Comply with ASTM D709.

2.03 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2-inch diameter.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2-inch diameter with smooth edges.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 **STENCILS**

A. Stencils: With clean cut symbols and letters of following size:

1. 3/4 to 1-1/4 inch (20-30 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 1/2 inch (15 mm) high letters.
2. 1-1/2 to 2 inch (40-50 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 3/4 inch (20 mm) high letters.
3. 2-1/2 to 6 inch (65-150 mm) Outside Diameter of Insulation or Pipe: 12 inch (300 mm) long color field, 1-1/4 inch (30 mm) high letters.
4. 8 to 10 inch (200-250 mm) Outside Diameter of Insulation or Pipe: 24 inch (600 mm) long color field, 2-1/2 inch (65 mm) high letters.
5. Ductwork and Equipment: 2-1/2 inch (65 mm) high letters.

B. Stencil Paint: As specified in Section 099123, semi-gloss enamel, colors complying with ASME A13.1.

2.05 **PIPE MARKERS**

A. Color: Comply with ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches (150 mm) wide by 4 mil (0.10 mm) thick, manufactured for direct burial service.

E. Color code as follows:

1. Heating, Cooling, and Boiler Feedwater: Green with white letters.
2. Toxic and Corrosive Fluids: Orange with black letters.
3. Compressed Air: Blue with white letters.

2.06 **CEILING TACKS**

A. Description: Steel with 3/4-inch (20 mm) diameter color coded head.

B. Color code as follows:

1. HVAC Equipment: Yellow.
2. Fire Dampers and Smoke Dampers: Red.
3. Heating/Cooling Valves: Blue.

PART 3 EXECUTION

3.01 **PREPARATION**

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 099123 for stencil painting.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Apply stencil painting in accordance with Section 099123.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G. Use tags on piping 3/4-inch diameter and smaller.

1. Identify service, flow direction, and pressure.
2. Install in clear view and align with axis of piping.
3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

H. Install ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

I. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

3.03 SCHEDULE

A. Equipment Type:

1. Identification:
2. Background:
   a. Size:
   b. Color:
3. Lettering:
   a. Size:
   b. Color:

END OF SECTION

SECTION 230593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic, steam and refrigerating systems.

C. Measurement of final operating condition of HVAC systems.

D. Sound measurement of equipment operating conditions.

E. Vibration measurement of equipment operating conditions.

F. Commissioning activities.

1.02 RELATED REQUIREMENTS

A. Section 019113 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

B. Section 230800 - Commissioning of HVAC.

C. Section 250500 - Common Work Results for Integrated Automation.

1.03 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition 2016.

B. ASHRAE Std 110 - Methods of Testing Performance of Laboratory Fume Hoods 2016.

C. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems 2008 (Reaffirmed 2017).

D. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems 2015, with Errata (2017).

E. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing 2002.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.

1. Submit to the Commissioning Authority.
2. Submit six weeks prior to starting the testing, adjusting, and balancing work.
3. Include at least the following in the plan:
   a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
   b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
   c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.

d. Final test report forms to be used.

e. Procedures for formal deficiency reports, including scope, frequency and distribution.

C. Field Logs: Submit at least twice a week to the Commissioning Authority.

D. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made, or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

E. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

1. Submit to the Commissioning Authority within two weeks after completion of testing, adjusting, and balancing.

2. Revise TAB plan to reflect actual procedures and submit as part of final report.

3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.

4. Provide reports in soft cover, 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.

5. Include actual instrument list, with manufacturer name, serial number, and date of calibration.

6. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.

7. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 **GENERAL REQUIREMENTS**

A. Perform total system balance in accordance with one of the following:

1. AABC (NSTSB), AABC National Standards for Total System Balance.

2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.

3. SMACNA (TAB).

4. Maintain at least one copy of the standard to be used at project site at all times.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:

1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.

3.02 **EXAMINATION**

A. Verify that systems are complete and operable 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. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed, and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place.
15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.

1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.

C. Provide additional balancing devices as required.

3.04 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 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.

3.05 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:

1. Running log of events and issues.

2. Discrepancies, deficient or uncompleted work by others.
3. Contract interpretation requests.
4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

H. Check and adjust systems approximately six months after final acceptance and submit report.

3.06 **AIR SYSTEM PROCEDURE**

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

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 extend 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. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

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. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches (12.5 Pa) positive static pressure near the building entries.

M. Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.

N. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

O. On fan powered VAV boxes, adjust air flow switches for proper operation.

3.07 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 gages 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 unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.08 COMMISSIONING

A. See Sections 019113 - General Commissioning Requirements and 230800 for additional requirements.

B. Perform prerequisites prior to starting commissioning activities.

C. Fill out Prefunctional Checklists for:

1. Air side systems.
2. Water side systems.

D. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.

E. Re-check minimum outdoor air intake flows and maximum and intermediate total airflow rates for [___] percent of the air handlers plus a random sample equivalent to [____] percent of the final TAB report data as directed by Commissioning Authority.

1. Original TAB agency shall execute the re-checks, witnessed by the Commissioning Authority.
2. Use the same test instruments as used in the original TAB work.
3. Failure of more than 10 percent of the re-checked items of a given system shall result in the rejection of the system TAB report; rebalance the system, provide a new system TAB report, and repeat random re-checks.
4. For purposes of re-check, failure is defined as follows:
   a. Air Flow of Supply and Return: Deviation of more than 10 percent of instrument reading.

b. Minimum Outside Air Flow: Deviation of more than 20 percent of instrument reading; for inlet vane or VFD OSHA compensation system using linear proportional control, deviation of more than 30 percent at intermediate supply flow.

c. Temperatures: Deviation of more than one-degree F (0.5 degree C).

d. Air and Water Pressures: Deviation of more than 10 percent of full scale of test instrument reading.

e. Sound Pressures: Deviation of more than 3 decibels, with consideration for variations in background noise.

5. For purposes of re-check, a whole system is defined as one in which inaccuracies will have little or no impact on connected systems; for example, the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system.

F. In the presence of the Commissioning Authority, verify that:

1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.

2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.

3. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90 percent or more open.

3.09 SCOPE

A. Test, adjust, and balance the following:

1. HVAC Pumps.

2. Centrifugal Water Chillers.

3. Induced Draft Cooling Tower.

4. Blow Through Cooling Tower.

5. Fans.

3.10 MINIMUM DATA TO BE REPORTED

A. Electric Motors:

1. Manufacturer.

2. Model/Frame.

3. HP/BHP.

4. Phase, voltage, amperage; nameplate, actual, no load.

5. RPM.
6. Service factor.
7. Starter size, rating, heater elements.
8. Sheave Make/Size/Bore.

B. V-Belt Drives:

1. Identification/location.
2. Required driven RPM.
3. Driven sheave, diameter and RPM.
4. Belt, size and quantity.
5. Motor sheave diameter and RPM.
6. Center to center distance, maximum, minimum, and actual.

C. Pumps:

1. Identification/number.
2. Manufacturer.
3. Size/model.
4. Impeller.
5. Service.
6. Design flow rate, pressure drop, BHP.
7. Actual flow rate, pressure drop, BHP.
8. Discharge pressure.
9. Suction pressure.
10. Total operating head pressure.
11. Shut off, discharge and suction pressures.
12. Shut off, total head pressure.

D. Combustion Equipment:

1. Boiler manufacturer.
2. Model number.
3. Serial number.
4. Firing rate.
5. Overfire draft.
6. Gas meter timing dial size.
7. Gas meter time per revolution.
8. Gas pressure at meter outlet.
9. Gas flow rate.
10. Heat input.

11. Burner manifold gas pressure.
12. Percent carbon monoxide (CO).
13. Percent carbon dioxide (CO2).
14. Percent oxygen (O2).
15. Percent excess air.
16. Flue gas temperature at outlet.
17. Ambient temperature.
18. Net stack temperature.
19. Percent stack loss.
20. Percent combustion efficiency.
21. Heat output.

E. Chillers:

1. Identification/number.
2. Manufacturer.
3. Capacity.
4. Model number.
5. Serial number.
6. Evaporator entering water temperature, design and actual.
7. Evaporator leaving water temperature, design and actual.
8. Evaporator pressure drop, design and actual.
9. Evaporator water flow rate, design and actual.
10. Condenser entering water temperature, design and actual.
11. Condenser pressure drop, design and actual.
12. Condenser water flow rate, design and actual.

F. Air Moving Equipment:

1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Arrangement/Class/Discharge.
6. Air flow specified and actual.
7. Return air flow, specified and actual.
8. Outside air flow, specified and actual.
9. Total static pressure (total external), specified and actual.
10. Inlet pressure.

11. Discharge pressure.
12. Sheave Make/Size/Bore.
13. Number of Belts/Make/Size.
14. Fan RPM.

G. Exhaust Fans:

1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Air flow specified and actual.
6. Total static pressure (total external), specified and actual.
7. Inlet pressure.
8. Discharge pressure.
9. Sheave Make/Size/Bore.
10. Number of Belts/Make/Size.
11. Fan RPM.

H. Duct Leak Tests:

1. Description of ductwork under test.
2. Duct design operating pressure.
3. Duct design test static pressure.
4. Duct capacity, air flow.
5. Maximum allowable leakage duct capacity times leak factor.
6. Test apparatus:
   a. Blower.
   b. Orifice, tube size.
   c. Orifice size.
   d. Calibrated.
7. Test static pressure.
8. Test orifice differential pressure.
9. Leakage.

I. Flow Measuring Stations:

1. Identification/number.
2. Location.
3. Size.
4. Manufacturer.

5. Model number.
6. Serial number.
7. Design Flow rate.
8. Design pressure drop.
9. Actual/final pressure drop.
10. Actual/final flow rate.
11. Station calibrated setting.

J. Sound Level Reports:

1. Location.
2. Octave bands - equipment off.
3. Octave bands - equipment on.

K. Vibration Tests:

1. Location of points:
   a. Fan bearing, drive end.
   b. Fan bearing, opposite end.
   c. Motor bearing, center (if applicable).
   d. Motor bearing, drive end.
   e. Motor bearing, opposite end.
   f. Casing (bottom or top).
   g. Casing (side).
   h. Duct after flexible connection (discharge).
   i. Duct after flexible connection (suction).
2. Test readings:
   a. Horizontal, velocity and displacement.
   b. Vertical, velocity and displacement.
   c. Axial, velocity and displacement.
3. Normally acceptable readings, velocity and acceleration.
4. Unusual conditions at time of test.
5. Vibration source (if non-complying).

END OF SECTION

SECTION 230713
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2019b.

B. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.02 SCHEDULES

A. Combustion Air Duct:

B. Exhaust Ducts Within 10 ft (3 m) of Exterior Openings:

C. Exhaust Ducts Exposed to Outdoor Air:

D. Outside Air Intake Ducts:

E. Plenums:

F. Return and Relief Ducts in Mechanical Rooms:

G. Ducts Exposed to Outdoors:

END OF SECTION

SECTION 230716
HVAC EQUIPMENT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Equipment insulation.

B. Breeching insulation.

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2019b.

B. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.

C. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum [_____] years of experience.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.05 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Exposed Equipment: Locate insulation and cover seams in least visible locations.

C. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

D. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

E. Insulated equipment containing fluids below ambient temperature; insulate entire system.

F. Fiber glass insulated equipment containing fluids below ambient temperature; provide vapor barrier jackets, factory-applied or field-applied. Finish with glass cloth and vapor barrier adhesive.

G. For hot equipment containing fluids 140 degrees F (60 degrees C) or less, do not insulate flanges and unions, but bevel and seal ends of insulation.

H. For hot equipment containing fluids over 140 degrees F (60 degrees C), insulate flanges and unions with removable sections and jackets.

I. Fiber glass insulated equipment containing fluids above ambient temperature; provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Finish with glass cloth and adhesive.

J. Inserts and Shields:

1. Application: Equipment 1-1/2 inches (40 mm) diameter or larger.
2. Shields: Galvanized steel between hangers and inserts.
3. Insert Location: Between support shield and equipment and under the finish jacket.
4. Insert Configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

K. Finish insulation at supports, protrusions, and interruptions.

L. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with canvas jacket sized for finish painting.

M. Exterior Applications:

1. Provide vapor barrier jacket or finish with glass mesh reinforced vapor barrier cement.
2. Cover with aluminum, stainless steel.

N. Cover glass fiber insulation with metal mesh and finish with heavy coat of insulating cement.

O. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

P. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

3.03 **SCHEDULE**

A. Heating Systems:

1. Pump Bodies:
2. Air Separators:
3. Expansion Tanks:
4. Stacks to Roof:
5. Boiler and Flue Boxes:

B. Cooling Systems:

1. Pump Bodies:
2. Air Separators:
3. Expansion Tanks:
4. Chiller Cold Surfaces (Not Factory Insulated):
5. Absorption Chiller Hot Surfaces (Not Factory Insulated):
6. Cold Thermal Storage Tanks:
7. Equipment Exposed to Freezing with Heat Tracing:

END OF SECTION

SECTION 230719
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Flexible removable and reusable blanket insulation.

C. Engineered wall outlet seals and refrigerant piping insulation protection.

1.02 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 078400 - Firestopping.

C. Section 232113 - Hydronic Piping: Placement of hangers and hanger inserts.

D. Section 232300 - Refrigerant Piping: Placement of inserts.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2019b.

B. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. For hot piping conveying fluids 140 degrees F (60 degrees C) or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

C. For hot piping conveying fluids over 140 degrees F (60 degrees C), insulate flanges and unions at equipment.

D. Inserts and Shields:

1. Application: Piping 1-1/2 inches (40 mm) diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert location: Between support shield and piping and under the finish jacket.
4. Insert Configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

E. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 078400.

F. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet (3 meters) above finished floor): Finish with canvas jacket sized for finish painting.

G. Exterior Applications: 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. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.

3.02 **SCHEDULE**

A. Heating Systems:

1. Heating Water Supply and Return:

B. Cooling Systems:

1. Chilled Water:
2. Condenser Water:
3. Dual Temperature Water:
4. Refrigerant Suction:
5. Refrigerant Hot Gas:
6. External Sprayed Coil Piping:

C. Other Systems:

1. Engine Exhaust Piping:

END OF SECTION

SECTION 230800
COMMISSIONING OF HVAC

PART 1 GENERAL

1.01 SUMMARY

A. See Section 019113 - General Commissioning Requirements for overall objectives; comply with the requirements of Section 019113.

B. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

C. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.

D. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:

1. Control system.
2. Major and minor equipment items.
3. Piping systems and equipment.
4. Sound control devices.
5. Vibration control devices.
6. Variable frequency drives.
7. Special Ventilation:
8. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

E. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.02 SUBMITTALS

A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. DRAFT Prefunctional Checklists and Functional Test Procedures for Control System: Detailed written plan indicating the procedures to be followed to test, checkout and adjust the control system prior to full system Functional Testing; include at least the following for each type of equipment controlled:

1. System name.
2. List of devices.
3. Step-by-step procedures for testing each controller after installation, including:
   a. Process of verifying proper hardware and wiring installation.
   b. Process of downloading programs to local controllers and verifying that they are addressed correctly.
   c. Process of performing operational checks of each controlled component.

d. Plan and process for calibrating valve and damper actuators and all sensors.

e. Description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.

4. Copy of proposed log and field checkout sheets to be used to document the process; include space for initial and final read values during calibration of each point and space to specifically indicate when a sensor or controller has "passed" and is operating within the contract parameters.

5. Description of the instrumentation required for testing.

6. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the Commissioning Authority and TAB contractor for this determination.

C. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.

D. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:

1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.

2. Full as-built set of control drawings.

3. Full as-built sequence of operations for each piece of equipment.

4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:

a. Floor.

b. Room number.

c. Room name.

d. Air handler unit ID.

e. Reference drawing number.

f. Air terminal unit tag ID.

g. Heating and/or cooling valve tag ID.

h. Minimum air flow rate.

i. Maximum air flow rate.

5. Full print out of all schedules and set points after testing and acceptance of the system.

6. Full as-built print out of software program.

7. Electronic copy on disk of the entire program for this facility.

8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.

9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.

10. Control equipment component submittals, parts lists, etc.
11. Warranty requirements.
12. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:
    a. Sequences of operation.
    b. Control drawings.
    c. Points lists.
    d. Controller and/or module data.
    e. Thermostats and timers.
    f. Sensors and DP switches.
    g. Valves and valve actuators.
    h. Dampers and damper actuators.
    i. Program setups (software program printouts).

E. Project Record Documents: See Section 017800 for additional requirements.
1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.

F. Draft Training Plan: In addition to requirements specified in Section 017900, include:
1. Follow the recommendations of ASHRAE Guideline 1.1.
2. Control system manufacturer's recommended training.
3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.

G. Training Manuals: See Section 017900 for additional requirements.
1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

PART 2 PRODUCTS

2.01 **TEST EQUIPMENT**

A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing, equipment will NOT become the property of Owner.

B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

PART 3 EXECUTION

3.01 **PREPARATION**

A. Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.

B. Furnish additional information requested by the Commissioning Authority.

C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.

D. Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.

E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.

F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.

G. Provide temperature and pressure taps in accordance with Contract Documents.

3.02 **INSPECTING AND TESTING - GENERAL**

A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.

B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.

C. Provide two-way radios for use during the testing.

D. Valve/Damper Stroke Setup and Check:

1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
2. Set pump/fan to normal operating mode.
3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
4. Command valve/damper open; verify position is full open and adjust output signal as required.
5. Command valve/damper to a few intermediate positions.
6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

E. Isolation Valve or System Valve Leak Check: For valves not by coils.

1. With full pressure in the system, command valve closed.
2. Use an ultra-sonic flow meter to detect flow or leakage.

F. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

3.03 **TAB COORDINATION**

A. TAB: Testing, adjusting, and balancing of HVAC.

B. Coordinate commissioning schedule with TAB schedule.

C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.

D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.

E. Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.

F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.04 CONTROL SYSTEM FUNCTIONAL TESTING

A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of Contract Documents and the detailed Sequences of Operation documentation submittal.

B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with Contract Documents.

C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.

D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.

1. The scope of trend logging is partially specified; trend log up to 50 percent more points than specified at no extra cost to Owner.

2. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.

E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.

F. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.

1. Setpoint changing features and functions.

2. Sensor calibrations.

G. Demonstrate to the Commissioning Authority:

1. That all specified functions and features are set up, debugged and fully operable.

2. That scheduling features are fully functional and setup, including holidays.

3. That all graphic screens and value readouts are completed.

4. Correct date and time setting in central computer.

5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to Owner.

6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any

ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to Owner.

7. Power failure and battery backup and power-up restart functions.
8. Global commands features.
9. Security and access codes.
10. Occupant over-rides (manual, telephone, key, keypad, etc.).
11. O&M schedules and alarms.
12. Occupancy sensors and controls.
13. Communications to remote sites.
14. That points that are monitored only, having no control function, are reporting properly to the control system.
15. All control strategies and sequences not tested during controlled equipment testing.
16. Trend logging and graphing features that are specified.
17. Other integrated tests specified in Contract Documents
18. That control system features that are included but not specified to be setup are actually installed.

H. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.

3.05 OPERATION AND MAINTENANCE MANUALS

A. See Section 017800 for additional requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.06 DEMONSTRATION AND TRAINING

A. See Section 017900 for additional requirements.

B. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

C. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.

D. Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned. Provide the following minimum durations of training:

1. HVAC Control System: up to 24 hours.

2. Chillers and System: up to 16 hours.
3. Boilers and System: up to 16 hours.

E. TAB Review: Instruct Owner's personnel for minimum up to 8 hours, after completion of TAB, on the following:

1. Review final TAB report, explaining the layout and meanings of each data type.
2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
5. Other salient information that may be useful for facility operations, relative to TAB.

F. HVAC Control System Training: Perform training in at least three phases:

1. Phase 1 - Basic Control System: Provide minimum of up to 8 hours of actual training on the control system itself. Upon completion of training, each attendee, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.
   a. This training may be held on-site or at the manufacturer's facility.
   b. If held off-site, the training may occur prior to final completion of the system installation.
   c. For off-site training, Contractor shall pay expenses of up to two attendees.
2. Phase 2 - Integrating with HVAC Systems: Provide minimum of up to 8 hours of on-site, hands-on training after completion of Functional Testing. Include instruction on:
   a. The specific hardware configuration of installed systems in this facility and specific instruction for operating the installed system, including interfaces with other systems, if any.
   b. Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.
   c. Trend logging and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends; provide practice in setting up trend logging and monitoring during training session.
   d. Every display screen, allowing time for questions.
   e. Use of keypad or plug-in laptop computer at the zone level.
   f. Use of remote access to the system via phone lines or networks.
   g. Graphics generation.
   h. Point database entry and modifications.
   i. Understanding DDC field panel operating programming, when applicable.

3. Phase 3 - Post-Occupancy: Six months after occupancy conduct minimum of up to 8 hours of training. Tailor training session to questions and topics solicited beforehand from Owner. Also be prepared to address topics brought up and answer questions concerning operation of the system.

G. Provide the services of manufacturer representatives to assist instructors where necessary.

H. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

END OF SECTION

SECTION 230913
INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Control panels.

B. Control Valves:

1. Ball valves and actuators.
2. Globe pattern.
3. Butterfly pattern.
4. Electronic operators.

C. Dampers.

D. Damper Operators:

1. Pneumatic operators.
2. Electric operators.
3. Inlet vane operators.

E. Input/Output Sensors:

1. Temperature sensors.
2. Humidity sensors.
3. Static pressure (air pressure) sensors.
4. Equipment operation (current) sensors.
5. Digital to pneumatic transducers.
6. Damper position indicators.
7. Carbon dioxide sensors.

F. Thermostats:

1. Electric room thermostats.
2. Low-limit temperature cutout switch (freezestat)
3. Room thermostat accessories.
4. Outdoor reset thermostats.
5. Airstream thermostats.

G. Transmitters:

1. Building static pressure transmitters.
2. Air pressure transmitters.
3. Water pressure transmitters (liquid differential pressure transmitters).
4. Temperature transmitters.
5. Humidity transmitters.

H. Flow Sensors:

1.02 **REFERENCE STANDARDS**

A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating 2018.

B. ANSI/FCI 70-2 - Control Valve Seat Leakage 2013.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2018.

D. NEMA DC 3 - Residential Controls - Electrical Wall-Mounted Room Thermostats 2013.

E. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances Current Edition, Including All Revisions.

1.03 **SUBMITTALS**

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

PART 2 PRODUCTS

2.01 **EQUIPMENT - GENERAL**

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.02 **CONTROL PANELS**

A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face.

B. NEMA 250, general purpose utility enclosures with enameled finished face panel.

C. Provide common keying for all panels.

2.03 **CONTROL VALVES**

A. Ball Valves and Actuators:

1. Service: Use for brine (30 percent glycol), chilled water, hot water or steam at 15 to 25 psig (104.4 to 172.4).

2. Flow Characteristic: Include 2-way and 3-way diverting operation configured to fail normally closed (NC).

3. Replacements in Kind: Provide pressure-independent type.

4. Rangeability: 500 to 1.

5. ANSI Rating: Class 150.

6. Leakage: Class IV (0.1 percent of rated capacity) per ANSI/FCI 70-2.

7. Body Size:

a. Under 2-1/2 inches (64 mm):

1) Connection: NPT.

2) Materials:

(a) Body: Brass.

(b) Flanges: Ductile iron.

(c) Ball: Chrome-plated brass.

(d) Stem: Nickel-plated brass.

(e) Seat: Graphite-reinforced PTFE with EPDM O-Ring backing.

(f) Stem Seal: EPDM O-Rings.

(g) Flow Control Disk: Thermoplastic synthetic-resin.

b. 2-1/2 inches (64 mm) and Above:

1) Connection Type: Flanged.

2) Materials:

(a) Body: Brass.

(b) Flanges: Ductile iron.

(c) Ball: 300 series stainless steel.

(d) Stem: 300 series stainless steel.

(e) Seat: Graphite-reinforced PTFE with EPDM O-Ring backing.

(f) Stem Seal: EPDM O-Rings.

(g) Flow Control Disk: Thermoplastic synthetic-resin.

c. Service Temperature:

1) Fluid Side: 0 to 284 degrees F (0 to 140 degrees C) liquid or 25 psig (172.4 kPa) steam.

2) Ambient Side: From minus 4 to 122 degrees F (minus 20 to 50 degrees C).

8. Actuator Requirements:

a. Assembly: Factory-mounted.

b. Input: 0 to 5 VDC configured for proportional control.

c. Accessories: Provide with valve position indicator and manual override.

B. Butterfly Pattern:

1. Iron body, bronze disc, resilient replaceable seat for service to 180 degrees F (82 degrees C) wafer or lug ends, extended neck.

2. Hydronic Systems:

a. Rate for service pressure of 125 psig at 250 degrees F (860 kPa at 121 degrees C).

b. Size for 1 psig (7 kPa) maximum pressure drop at design flow rate.

2.04 DAMPERS

A. Performance: Test in accordance with AMCA 500-D.

B. Frames: Galvanized steel, welded or riveted with corner reinforcement, minimum 12 gage, 0.1046 inch (2.66 mm).

C. Blades: Galvanized steel, maximum blade size 8 inches (200 mm) wide, 48 inches (1200 mm) long, minimum 22 gage, 0.0299-inch (0.76 mm), attached to minimum 1/2-inch (13 mm) shafts with set screws.

D. Leakage: Less than one percent based on approach velocity of 2000 ft per min (10 m per sec) and 4 inches wg (1.0 kPa).

E. Maximum Pressure Differential: 6 inches wg (1.5 kPa).

F. Temperature Limits: Minus 40 to 200 degrees F (Minus 40 to 93 degrees C).

2.05 DAMPER OPERATORS

A. General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.

1. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
2. Provide one operator for maximum 36 sq. ft (3.34 sq. m) damper section.

B. Pneumatic Operators:

1. Rolling diaphragm piston type with adjustable stops.
2. Pilot Positioners: Starting point adjustable from 2 to 12 psig (15 to 83 kPa) and operating span adjustable from 5 to 13 psig (35 to 90 kPa).

C. Electric Operators:

1. Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch.

D. Inlet Vane Operators:

1. High pressure with pilot positioners and sufficient force to move vanes when fan is started with vanes in closed position. Return vane operator to closed position on fan shutdown.

2.06 INPUT/OUTPUT SENSORS

A. Temperature Sensors:

1. Use thermistor or RTD type temperature sensing elements with characteristics resistant to moisture, vibration, and other conditions consistent with the application without affecting accuracy and life expectancy.
2. Construct RTD of nickel or platinum with base resistance of 1000 ohms at 70 degrees F (26 degrees C).
3. 100-ohm platinum RTD is acceptable if used with project DDC controllers.
4. Temperature Sensing Device: Compatible with project DDC controllers.
5. Performance Characteristics:
   a. RTD:
      1) Room Sensor Accuracy: Plus/minus 0.50 degrees F (0.28 degrees C) minimum.
      2) Duct Averaging Accuracy: Plus/minus 0.50 degrees F (0.28 degrees C) minimum.
      3) Chilled Water Accuracy: Plus/minus 0.50 degrees F (0.28 degrees C) minimum.

4) All Other Accuracy: Plus/minus 0.75 degrees F (0.42 degrees C) minimum.

5) Range: Minus 40 degrees F (Minus 40 degrees C) through 220 degrees F (104.4 degrees C) minimum.

b. Temperature Transmitter:

1) Accuracy: 0.10-degree F minimum or plus/minus 0.20 percent of span.

2) Output: 4 to 20 mA.

c. Sensing Range:

1) Provide limited range sensors if required to sense the range expected for a respective point.

2) Use RTD type sensors for extended ranges beyond minus 30 degrees F to 230 degrees F.

3) Use temperature transmitters in conjunction with RTD's when RTD's are incompatible with DDC controller direct temperature input.

B. Static Pressure (Air Pressure) Sensors:

1. Unidirectional with ranges not exceeding 150 percent of maximum expected input.

2. Temperature compensate with typical thermal error or 0.06 percent of full scale in temperature range of 40 to 100 degrees F.

3. Accuracy: One percent of full scale with repeatability 0.3 percent.

4. Output: 0 to 5 vdc with power at 12 to 28 vdc.

C. Equipment Operation (Current) Sensors:

1. Status Inputs for Fans: Differential pressure switch with adjustable range of 0 to 5 inches wg (0 to 1250 Pa).

2. Status Inputs for Pumps: Differential pressure switch piped across pump with adjustable pressure differential range of 8 to 60 psi.

3. Status Inputs for Electric Motors: Current sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.

D. Digital to Pneumatic Transducers:

1. Convert plus or minus 12 vdc pulse width modulation outputs to 0 to 20 psi (0 to 138 kPa).

E. Damper Position Indicators: Potentiometer mounted in enclosure with adjustable crank arm assembly connected to damper to transmit 0 to 100 percent damper travel.

F. Carbon Dioxide Sensors, Duct and Wall:

1. General: Provide non-dispersive infrared (NDIR), diffusion sampling CO2 sensors with integral transducers and linear output.

2. Air Temperature: Range of 32 to 122 degrees F.

3. Relative Humidity: Range of 0 to 95 percent (non-condensing).

4. Power Input: Class 2; 12 to 30VDC or 24VAC 50/60 Hz; 100mA max.

5. Calibration Characteristics:

a. Automatically compensating algorithm for sensor drift due to sensor degradation.

b. Maximum Drift: 2 percent.

c. User calibratable with a minimum calibration interval of 5 years.

6. Construction:

a. Sensor Chamber: Non-corrosive material for neutral effect on carbon dioxide sample.

b. Provide duct mounted sensors with duct probe designed to protect sensing element from dust accumulation and mechanical damage.

c. Housing: High impact plastic.

7. Optional Equipment

a. Temperature Sensor:

1) Solid state, integrated circuit; Accuracy: Plus/minus 1-degree F (0.5 degrees C); Resolution: 0.2 degrees F (0.1 degrees C); Output Range: 50 to 95 degrees F (10 to 35 degrees C).

2.07 THERMOSTATS

A. Electric Room Thermostats:

1. Type: NEMA DC 3, 24 volts, with setback/setup temperature control.

2. Service: Cooling only.

3. Covers: Locking with set point adjustment, with thermometer.

B. Outdoor Reset Thermostats:

1. Remote bulb or bimetal rod and tube type, proportioning action with adjustable throttling range, adjustable setpoint.

2. Scale range: Minus 10 to 70 degrees F (2 to 35 degrees C).

C. Airstream Thermostats:

1. Remote bulb or bimetallic rod and tube type, proportional action with adjustable setpoint in middle of range and adjustable throttling range.

2. Averaging service remote bulb element: 7.5 feet (2.3 m).

2.08 TRANSMITTERS

A. Building Static Pressure Transmitters:

1. One pipe, direct acting, double bell, scale range 0.01 to 6.0-inch wg (.0025 to 1.5 kPa) positive or negative, and sensitivity of 0.0005-inch wg (0.125 Pa). Transmit electronic signal to receiver with matching scale range.

B. Air Pressure Transmitters:

1. General: Provide dry media differential pressure transducers to monitor duct, room and [____] pressure.

a. Media Compatibility: Dry air.

b. Input Power: Class 2; 12 to 30 VDC; 2-wire: 20 mA max.

c. Output: Field selectable, 2-wire, loop-powered 4 to 20 mA (DC only, clipped and capped).

d. Pressure Ranges: 4 and 7, field selectable.

e. Response Time:

1) Standard: T95 in 20 seconds.

2) Fast: T95 in 2 seconds.

3) Switch selectable.

f. Mode: Switch selectable, unidirectional.

g. Display:

1) Signed 3-1/2-digit LCD, indicates pressure.

2) Over-range indicator.

h. Proof Pressure (pressure differential): 3 psid (20.6 kPa).

i. Burst Pressure (pressure differential): 5 psid (34.5 kPa).

j. Accuracy: Plus/minus 1 percent f.s. (full scale) of selected range (combined linearity & hysteresis).

k. Temperature Effect (per transmitter size):

1) 1-inch w.c. (250 Pa): 2.0 percent per degree C.

2) 10-inch w.c. (2.5 kPa): 0.01 percent per degree C.; (Relative to 25 degrees C) 32 degrees F (0 degrees C) to 122 degrees F (50 degrees C).

l. Zero Drift (1-year) (per transmitter size):

1) 1-inch w.c. (250 Pa): 2 percent maximum.

2) 10 inch (2.5 kPa): 0.05 percent maximum.

m. Fittings:

1) Brass barb.

2) 0.24 inches (6.1 mm) outer diameter.

3) UL 94 V-O fire retardant ABS.

C. Water Pressure Transmitters (Liquid Differential Pressure Transmitters):

1. Manufacturers:

a. Substitutions: See Section 016000 - Product Requirements.

2. General: Provide wet media differential pressure transducers with 6 ft (1.83 m) armored cable, to allow remote pressure sensing capability using existing plumbing runs.

a. Input Power: Class 2; 15 to 30 VDC, 24VAC nominal, 50/60 Hz.

b. Maximum Current Draw:

1) DC: 125 mA.

2) AC: 280 mA.

c. Output: 3-wire transmitter; user-selectable, 4 to 20 mA (0 to 5V/0 to 10V).

d. Sensor:

e. Operating Conditions:

1) Temperature Compensated Range:

(a) 32 degrees F (0 degrees C).

(b) TC Zero less than 1.5 percent of product F.S. (full scale) per sensor.

(c) TC Span less than 1.5 percent of product F.S. (full scale) per sensor.

2) Sensor Operating Range: Minus 4 degrees F (Minus 20 degrees C) to 185 degrees F (85 degrees C).

3) Operating Environment: 14 degrees F (Minus 10 degrees C) to 122 degrees F (50 degrees C); 10 to 90 percent RH noncondensing.

D. Temperature Transmitters:

1. One pipe, directly proportional output signal to measured variable, linearity within plus or minus 1/2 percent of range for 200 degrees F (93 degrees C) span and plus or minus 1 percent for 50 degrees F (10 degrees C) span, with 50 degrees F (10 degrees C). temperature range, compensated bulb, averaging capillary, or rod and tube operation on 20 psig (138 kPa) input pressure and 3 to 15 psig (20 to 100 kPa) output.

E. Humidity Transmitters:

1. One pipe directly proportioned output signal to measured variable, linearity within plus or minus 1 percent for 70 percent relative humidity span, capable of withstanding 95 percent relative humidity without loss of calibration.

PART 3 EXECUTION

3.01 **EXAMINATION**

3.02 **INSTALLATION**

A. Install in accordance with manufacturer's instructions.

B. Check and verify location of thermostats with plans and room details before installation. Locate 60 inches (1500 mm) above floor. Align with lighting switches and humidistats. Refer to Section 262726.

C. Provide conduit and electrical wiring in accordance with Section 260583. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

3.03 **SCHEDULES**

A. Control Valve Schedule

1. Drawing Code

2. Valve Size

3. Valve CV

4. Operator Spring Range

5. Normal Position

B. Control Damper Schedule

1. Drawing Code

2. Height
3. Width
4. Air Flow
5. Air Pressure Drop

END OF SECTION

SECTION 230923
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. System description.

B. Operator interface.

C. Controllers.

D. System software.

E. Controller software.

F. Chiller control programs.

1.02 RELATED REQUIREMENTS

A. Section 230913 - Instrumentation and Control Devices for HVAC.

B. Section 230993 - Sequence of Operations for HVAC Controls.

C. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 SYSTEM DESCRIPTION

A. Automatic temperature control field monitoring and control system using field programmable micro-processor-based units.

B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

C. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

D. Controls for variable air volume terminals, radiation, reheat coils, unit heaters, fan coils, and the like when directly connected to the control units. Individual terminal unit control is specified in Section 230913.

E. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

F. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

2.03 OPERATOR INTERFACE

A. PC Based Workstation:

B. Workstation, controllers, and control backbone to communicate using BACnet protocol and addressing.

C. Hardware:

2.04 CONTROLLERS

A. Building Controllers:

1. General:

   a. Manage global strategies by one or more, independent, standalone, microprocessor-based controllers.

   b. Provide sufficient memory to support controller's operating system, database, and programming requirements.

   c. Share data between networked controllers.

   d. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.

   e. Utilize real-time clock for scheduling.

   f. Continuously check processor status and memory circuits for abnormal operation.

   g. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.

   h. Communication with other network devices to be based on assigned protocol.

2. Communication:

   a. Controller to reside on a BACnet network using ISO 8802-3 (ETHERNET) Data Link/Physical layer protocol.

   b. Perform routing when connected to a network of custom application and application specific controllers.

   c. Provide service communication port for connection to a portable operator's terminal or handheld device with compatible protocol.

3. Anticipated Environmental Ambient Conditions:

   a. Outdoors and/or in Wet Ambient Conditions:

      1) Mount within waterproof enclosures.

      2) Rated for operation at 40 to 150 degrees F (4 to 65 degrees C).

   b. Conditioned Space:

      1) Mount within dustproof enclosures.

      2) Rated for operation at 32 to 120 degrees F (0 to 50 degrees C).

4. Provisions for Serviceability:

   a. Diagnostic LEDs for power, communication, and processor.

   b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.

5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.

6. Power and Noise Immunity:

   a. Maintain operation at 90 to 110 percent of nominal voltage rating.

b. Perform orderly shutdown below 80 percent of nominal voltage.

c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet (1 m).

B. Input/Output Interface:

1. Hardwired inputs and outputs tie into the DDC system through building, custom application, or application specific controllers.

2. All Input/Output Points:

a. Protect controller from damage resulting from any point short-circuiting or grounding and from voltage up to 24 volts of any duration.

b. Provide universal type for building and custom application controllers where input or output is software designated as either binary or analog type with appropriate properties.

3. Binary Inputs:

a. Allow monitoring of On/Off signals from remote devices.

b. Provide wetting current of 12 mA minimum, compatible with commonly available control devices and protected against the effects of contact bounce and noise.

c. Sense dry contact closure with power provided only by the controller.

4. Pulse Accumulation Input Objects: Comply with all requirements of binary input objects and accept up to 10 pulses per second.

5. Analog Inputs:

a. Allow for monitoring of low voltage 0 to 10 VDC, 4 to 20 mA current, or resistance signals (thermistor, RTD).

b. Compatible with and field configurable to commonly available sensing devices.

6. Binary Outputs:

a. Used for On/Off operation or a pulsed low-voltage signal for pulse width modulation control.

b. Outputs provided with three position (On/Off/Auto) override switches.

c. Status lights for building and custom application controllers to be selectable for normally open or normally closed operation.

7. Analog Outputs:

a. Monitoring signal provides a 0 to 10 VDC or a 4 to 20 mA output signal for end device control.

b. Provide status lights and two position (AUTO/MANUAL) switch for building and custom application controllers with manually adjustable potentiometer for manual override on building and custom application controllers.

c. Drift to not exceed 0.4 percent of range per year.

8. Tri State Outputs:

a. Coordinate two binary outputs to control three-point, floating type, electronic actuators without feedback.

b. Limit the use of three-point, floating devices to the following zone and terminal unit control applications:

c. Control algorithms run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.

9. System Object Capacity:

a. System size to be expandable to twice the number of input output objects required by providing additional controllers, including associated devices and wiring.

b. Hardware additions or software revisions for the installed operator interfaces are not to be required for future, system expansions.

2.05 SYSTEM SOFTWARE

A. Operating System:

1. Concurrent, multi-tasking capability.

a. Common Software Applications Supported: Microsoft Excel.

b. Acceptable Operating Systems:

2. System Graphics:

a. Allow up to 10 graphic screens, simultaneously displayed for comparison and monitoring of system status.

b. Animation displayed by shifting image files based on object status.

c. Provide method for operator with password to perform the following:

1) Move between, change size, and change location of graphic displays.

2) Modify on-line.

3) Add, delete, or change dynamic objects consisting of:

(a) Analog and binary values.

(b) Dynamic text.

(c) Static text.

(d) Animation files.

3. Custom Graphics Generation Package:

a. Create, modify, and save graphic files and vision format graphics in PCX formats.

b. HTML graphics to support web browser compatible formats.

c. Capture or convert graphics from AutoCAD.

4. Standard HVAC Graphics Library:

a. HVAC Equipment:

1) Chillers.

2) Boilers.

b. Ancillary Equipment:

1) Fans.

2) Pumps.

3) Valves.

4) Piping.

5) Dampers.

B. Workstation System Applications:

1. Automatic System Database Save and Restore Functions:

a. Current database copy of each Building Controller is automatically stored on hard disk.

b. Automatic update occurs upon change in any system panel.

c. In the event of database loss in any system panel, the first workstation to detect the loss automatically restores the database for that panel unless disabled by the operator.

2. Manual System Database Save and Restore Functions by Operator with Password Clearance:

a. Save database from any system panel.

b. Clear a panel database.

c. Initiate a download of a specified database to any system panel.

3. Software provided allows system configuration and future changes or additions by operators under proper password protection.

4. On-line Help:

a. Context-sensitive system assists operator in operation and editing.

b. Available for all applications.

c. Relevant screen data provided for particular screen display.

d. Additional help available via hypertext.

5. Security:

a. Operator log-on requires username and password to view, edit, add, or delete data.

b. System security selectable for each operator.

c. System supervisor sets passwords and security levels for all other operators.

d. Operator passwords to restrict functions accessible to viewing and/or changing system applications, editor, and object.

e. Automatic, operator log-off results from keyboard or mouse inactivity during user-adjustable, time period.

f. All system security data stored in encrypted format.

6. System Diagnostics:

a. Operations Automatically Monitored:

1) Workstations.

2) Printers.

3) Modems.

4) Network connections.

5) Building management panels.

6) Controllers.

b. Device failure is annunciated to the operator.

7. Alarm Processing:

a. All system objects are configurable to "alarm in" and "alarm out" of normal state.

b. Configurable Objects:

1) Alarm limits.

2) Alarm limit differentials.

3) States.

4) Reactions for each object.

8. Alarm Messages:

a. Descriptor: English language.

b. Recognizable Features:

1) Source.

2) Location.

3) Nature.

9. Configurable Alarm Reactions by Workstation and Time of Day:

a. Logging.

b. Printing.

c. Starting programs.

d. Displaying messages.

e. Dialing out to remote locations.

f. Paging.

g. Providing audible annunciation.

h. Displaying specific system graphics.

10. Custom Trend Logs:

a. Definable for any data object in the system including interval, start time, and stop time.

b. Trend Data:

1) Sampled and stored on the building controller panel.

2) Archivable on hard disk.

3) Retrievable for use in reports, spreadsheets and standard database programs.

4) Archival on LAN accessible storage media including hard disk, tape, Raid array drive, and virtual cloud environment.

5) Protected and encrypted format to prevent manipulation or editing of historical data and event logs.

11. Alarm and Event Log:
    a. View all system alarms and change of states from any system location.
    b. Events listed chronologically.
    c. Operator with proper security acknowledges and clears alarms.
    d. Alarms not cleared by operator are archived to the workstation hard disk.
12. Object, Property Status and Control:
    a. Provide a method to view, edit if applicable, the status of any object and property in the system.
    b. Status Available by the Following Methods:
        1) Menu.
        2) Graphics.
        3) Custom Programs.
13. Reports and Logs:
    a. Reporting Package:
        1) Allows operator to select, modify, or create reports.
        2) Definable as to data content, format, interval, and date.
        3) Archivable to hard disk.
    b. Real-time logs available by type or status such as alarm, lockout, normal, etc.
    c. Stored on hard disk and readily accessible by standard software applications, including spreadsheets and word processing.
    d. Set to be printed on operator command or specific time(s).
14. Reports:
    a. Standard:
        1) Objects with current values.
        2) Current alarms not locked out.
        3) Disabled and overridden objects, points and SNVTs.
        4) Objects in manual or automatic alarm lockout.
        5) Objects in alarm lockout currently in alarm.
        6) Logs:
            (a) Alarm History.
            (b) System messages.
            (c) System events.
            (d) Trends.
    b. Custom:
        1) Daily.

2) Weekly.

3) Monthly.

4) Annual.

5) Time and date stamped.

6) Title.

7) Facility name.

c. Tenant Override:

1) Monthly report showing total, requested, after-hours HVAC and lighting services on a daily basis for each tenant.

2) Annual report showing override usage on a monthly basis.

d. Electrical, Fuel, and Weather:

1) Electrical Meter(s):

(a) Monthly showing daily electrical consumption and peak electrical demand with time and date stamp for each meter.

(b) Annual summary showing monthly electrical consumption and peak demand with time and date stamp for each meter.

2) Fuel Meter(s):

(a) Monthly showing daily natural gas consumption for each meter.

(b) Annual summary showing monthly consumption for each meter.

3) Weather:

(a) Monthly showing minimum, maximum, average outdoor air temperature and heating/cooling degree-days for the month.

e. Daily Operating Condition of Chiller(s) Based on ASHRAE Std 147:

1) Chilled water inlet and outlet temperature.

2) Chilled water flow.

3) Chilled water inlet and outlet pressure.

4) Evaporator refrigerant pressure and temperature.

5) Condenser refrigerant pressure and temperature.

6) Condenser refrigerant pressure and liquid temperature.

7) Refrigerant levels.

8) Oil pressure and temperature.

9) Oil level.

10) Compressor refrigerant discharge temperature.

11) Refrigerant suction temperature.

12) Addition of refrigerant.

13) Addition of oil.

14) Motor amperes per phase.

15) Motor volts per phase.

16) Ambient temperature (dry-bulb and wet-bulb).

17) Date and time logged.

C. Workstation Applications Editors:

1. Provide editing software for each system application at PC workstation.
2. Downloaded application is executed at controller panel.
3. Full screen editor for each application allows operator to view and change:
   a. Configuration.
   b. Name.
   c. Control parameters.
   d. Set-points.
4. Scheduling:
   a. Monthly calendar indicates schedules, holidays, and exceptions.
   b. Allows several related objects to be scheduled and copied to other objects or dates.
   c. Start and stop times adjustable from master schedule.
5. Custom Application Programming:
   a. Create, modify, debug, edit, compile, and download custom application programming during operation and without disruption of all other system applications.
   b. Programming Features:
      1) English oriented language, based on BASIC, FORTRAN, C, or PASCAL syntax allowing for free form programming.
      2) Alternative language graphically based using appropriate function blocks suitable for all required functions and amenable to customizing or compounding.
      3) Insert, add, modify, and delete custom programming code that incorporates word processing features such as cut/paste and find/replace.
      4) Allows the development of independently, executing, program modules designed to enable and disable other modules.
      5) Debugging/simulation capability that displays intermediate values and/or results including syntax/execution error messages.
      6) Support for conditional statements (IF/THEN/ELSE/ELSE-F) using compound Boolean (AND, OR, and NOT) and/or relations (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.
      7) Support for floating-point arithmetic utilizing plus, minus, divide, times, square root operators; including absolute value; minimum/maximum value from a list of values for mathematical functions.
      8) Language consisting of resettable, predefined, variables representing time of day, day of the week, month of the year, date; and elapsed time in seconds, minutes,

hours, and days where the variable values cab be used in IF/THEN comparisons, calculations, programming statement logic, etc.

9) Language having predefined variables representing status and results of the system software enables, disables, and changes the set points of the controller software.

2.06 CONTROLLER SOFTWARE

A. All applications reside and operate in the system controllers and editing of all applications occurs at the operator workstation.

B. System Security:

1. User access secured via user passwords and usernames.
2. Passwords restrict user to the objects, applications, and system functions as assigned by the system manager.
3. User Log On/Log Off attempts are recorded.
4. Automatic Log Off occurs following the last keystroke after a user defined delay time.

C. Object or Object Group Scheduling:

1. Weekly Schedules Based on Separate, Daily Schedules:
   a. Include start, stop, optimal stop, and night economizer.
   b. 10 events maximum per schedule.
   c. Start/stop times adjustable for each group object.

D. Provide standard application for equipment coordination and grouping based on function and location to be used for scheduling and other applications.

E. Alarms:

1. Binary object is set to alarm based on the operator specified state.
2. Analog object to have high/low alarm limits.
3. All alarming is capable of being automatically and manually disabled.
4. Alarm Reporting:
   a. Operator determines action to be taken for alarm event.
   b. Alarms to be routed to appropriate workstation.
   c. Reporting Options:

F. Maintenance Management: System monitors equipment status and generates maintenance messages based upon user-designated run-time limits.

G. Sequencing: Application software based upon specified sequences of operation in Section 230993.

H. PID Control Characteristics:

1. Direct or reverse action.
2. Anti-windup.
3. Calculated, time-varying, analog value, positions an output or stages a series of outputs.
4. User selectable controlled variable, set-point, and PED gains.

I. Staggered Start Application:

1. Prevents all controlled equipment from simultaneously restarting after power outage.
2. Order of equipment startup is user selectable.

J. Energy Calculations:

1. Accumulated instantaneous power or flow rates are converted to energy use data.
2. Algorithm calculates a rolling average and allows window of time to be user specified in minute intervals.
3. Algorithm calculates a fixed window average with a digital input signal from a utility meter defining the start of the window period that in turn synchronizes the fixed-window average with that used by the power company.

K. Anti-Short Cycling:

1. All binary output objects protected from short-cycling.
2. Allows minimum on-time and off-time to be selected.

L. On-Off Control with Differential:

1. Algorithm allows binary output to be cycled based on a controlled variable and set-point.
2. Algorithm to be direct-acting or reverse-acting incorporating an adjustable differential.

M. Run-Time Totalization:

1. Totalize run-times for all binary input objects.
2. Provides operator with capability to assign high run-time alarm.

PART 3 EXECUTION

3.01 **INSTALLATION**

A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

B. Install software in control units and in operator workstation. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 230993.

C. Provide conduit and electrical wiring in accordance with Section 260583. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

3.02 **MANUFACTURER'S FIELD SERVICES**

A. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

B. Provide service engineer to instruct Owner's representative in operation of systems plant and equipment for 3-day period.

C. Provide basic operator training for [____] persons on data display, alarm and status descriptors, requesting data, execution of commands and request of logs. Include a minimum of 40 hours dedicated instructor time. Provide training on site.

3.03 **SCHEDULES**

A. Input/Output Schedule:

1. Point Description:
2. Digital Input:
3. Digital Output:
4. Analog Input:
5. Analog Output:
6. Alarm:

B. Input/Output Schedule:

1. Point Description:
2. Inputs:
    a. Temperature:
    b. Relative Humidity:
    c. Pressure:
    d. Flow:
    e. Level:
    f. Position:
    g. Energy:
    h. Power:
3. Outputs:
    a. Status:
    b. Alarm:
    c. Electronic Position:
4. Software Features:
    a. PID Control (DDC):
    b. High Limit:
    c. Low Limit:
    d. Run Time Totalization:
    e. Consumption Totalization:
    f. Program Start/Stop:
    g. Load Shed:
    h. Duty Cycle:
    i. Optimal Run Time:

C. Alarm Schedule:

1. High Limit: A1.
2. Low Limit: A2.
3. Run Time: A3.

4. Maintenance: A4.
5. Status: A5.
6. Override: A6.
7. Freeze: A7.
8. Low Pressure: A8.

END OF SECTION

SECTION 230993
SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other sections.

B. Sequence of operation for:

1. Central refrigeration systems.
2. Heating water zone control.
3. Refrigeration systems.

1.02 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Sequence of Operation Documentation: Submit written sequence of operation for entire HVAC system and each piece of equipment.

1. Preface: 1 or 2 paragraph overview narrative of the system describing its purpose, components and function.
2. State each sequence in small segments and give each segment a unique number for referencing in Functional Test procedures; provide a complete description regardless of the completeness and clarity of the sequences specified in Contract Documents.

C. Control System Diagrams: Submit graphic schematic of the control system showing each control component and each component controlled, monitored, or enabled.

D. Points List: Submit list of all control points indicating at least the following for each point.

1. Name of controlled system.
2. Point abbreviation.
3. Point description; such as dry bulb temperature, airflow, etc.
4. Display unit.
5. Control point or setpoint (Yes / No); i.e. a point that controls equipment and can have its setpoint changed.
6. Monitoring point (Yes / No); i.e. a point that does not control or contribute to the control of equipment but is used for operation, maintenance, or performance verification.
7. Intermediate point (Yes / No); i.e. a point whose value is used to make a calculation which then controls equipment, such as space temperatures that are averaged to a virtual point to control reset.
8. Calculated point (Yes / No); i.e. a “virtual” point generated from calculations of other point values.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CENTRAL REFRIGERATION SYSTEMS

A. Time Schedule: Start and stop condensing water pump.

B. Condensing Water Pump: Allow start on proof of water in cooling tower sump and on outdoor temperature above 50 degrees F (10 degrees C). Start on demand from ventilation system.

C. Energize chilled water pump to start and allow cooling tower fans to start when condensing water pump started.

D. When chilled water pump starts, open chiller control valve.

E. Modulate chiller control valve to maintain constant flow through chiller.

F. When chilled water flow and condensing water flow are proven by flow switches, allow refrigeration machine to start.

G. Maintain minimum condenser water temperature of 55 degrees F by modulating tower bypass valve.

H. Maintain temperature in cooling tower sump of 40 degrees F by modulating heater control valve. Outdoor thermostat set at 35 degrees F shall open valve to activate electric heat tracing.

I. Thermostat in cooling tower sump, set at 35 degrees F, opens drain lines, closes make-up valve, and deactivates sump heaters and piping electric heat tapes.

J. Display:

1. System graphic.
2. Condensing water pump on/off indication.
3. Chilled water pump on/off switch.
4. Chiller on/off indication.
5. Chiller condensing water supply and return temperature.
6. Chiller chilled water supply and return temperature.
7. Chiller condensing water control point adjustment.
8. Common chilled water control point adjustment.
9. Low level cooling tower sump alarm.
10. Expansion tank low level alarm.
11. Cooling tower fan on/off indication.
12. Cooling tower sump heater on/off indication.
13. Cooling tower dump indication.
14. Chilled water control point adjustment.
15. Condensing water pump on/off switch.
16. Chilled water pump on/off/auto switch.
17. Chiller on/off switch.

3.02 HEATING WATER ZONE CONTROL

A. Flow switch in heating pump discharge provides on/off indication.

B. Control heating water supply temperature set at 195 degrees F in accordance with outdoor reset schedule by modulating steam control valve.

C. Control heating water at maximum 195 degrees F at outdoor temperature of minus 30 degrees F (minus 35 degrees C), and minimum 130 degrees F at outdoor temperature of 75 degrees F, with straight line relationship between.

D. Step fire boilers in sequence, Boiler No. 1 - low fire, Boiler No. 1 - high fire, Boiler No. 2 - low fire, Boiler No. 2 - high fire.

E. Flow switch in heating water circuit on no flow conditions closes valve and indicates alarm.

F. On outside temperatures above 65 degrees F (18 degrees C), de-energize heating pumps and suppress alarm.

G. Display:

1. System graphic.
2. System supply temperature.
3. System supply control point adjustment.
4. System return temperature.
5. Pump on/off indication.
6. Pump on/off switch.
7. Boiler lead lag switch.

3.03 **REFRIGERATION SYSTEMS**

A. Maintain constant supply air duct temperature of 55 degrees F by cycling refrigeration system and signaling step capacity, minimum of steps.

END OF SECTION

SECTION 231123
FACILITY NATURAL-GAS PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for natural gas piping systems.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 220516 - Expansion Fittings and Loops for Plumbing Piping.

C. Section 220719 - Plumbing Piping Insulation.

1.03 REFERENCE STANDARDS

A. ANSI Z223.1 - National Fuel Gas Code 2016.

B. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications 2019.

C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2016.

D. ASME B31.1 - Power Piping 2018.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2018.

F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

G. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2019.

H. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems 2010.

I. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends 2011.

J. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Welder Certificate: Include welders' certification of compliance with ASME BPVC-IX.

D. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.

E. Sustainable Design Documentation: For soldered copper joints, submit installer's certification that the specified installation method and materials were used.

F. Project Record Documents: Record actual locations of valves.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.

2. Valve Repacking Kits: One for each type and size of valve.

PART 2 PRODUCTS

2.01 **NATURAL GAS PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING**

A. Steel Pipe: ASTM A53/A53M, Schedule 40 black.

1. Fittings: ASTM A234/A234M, wrought steel welding type.
2. Joints: ANSI Z223.1, welded.
3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil (0.25 mm) polyethylene tape.

2.02 **NATURAL GAS PIPING, ABOVE GRADE**

A. Steel Pipe: ASTM A53/A53M, Schedule 40 black.

1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
2. Joints: Threaded or welded to ASME B31.1.

2.03 **PIPE HANGERS AND SUPPORTS**

A. Provide hangers and supports that comply with MSS SP-58.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
   a. Cold and Hot Pipe Sizes 6 Inches (150 mm) and Over: Double hangers.
3. Trapeze Hangers: Welded steel channel frames attached to structure.
4. Vertical Pipe Support: Steel riser clamp.
5. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.
6. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
   a. Bases: High density polypropylene.
   b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
   c. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
   d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
   e. Height: Provide minimum clearance of 6 inches (150 mm) under pipe to top of roofing.

2.04 **BALL VALVES**

A. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, ductile iron or body, 304 stainless steel, chrome plated brass or ball, regular port, Teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder, threaded, grooved or ends with union.

2.05 **PLUG VALVES**

A. Construction 2-1/2 Inches and Larger: MSS SP-78, 175 psi CWP, cast iron body and plug, pressure lubricated, Teflon or Buna N packing, flanged or grooved ends. Provide lever operator with set screw.

2.06 **STRAINERS**

A. Size 2 inch and Under:

1. Threaded brass body for 175 psi CWP, Y pattern with 1/32-inch stainless steel perforated screen.

2. Class 150, threaded bronze body 300 psi (2070 kPa) CWP, Y pattern with 1/32-inch stainless steel perforated screen.

PART 3 EXECUTION

3.01 **INSTALLATION**

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

C. Install piping to maintain headroom, conserve space, and not interfere with use of space.

D. Group piping whenever practical at common elevations.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 220516.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

1. Refer to Section 220719.

G. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.

H. Pipe Hangers and Supports:

1. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.02 **SCHEDULES**

A. Pipe Hanger Spacing:

1. Metal Piping:

a. Pipe Size: 1/2 inches to 1-1/4 inches:

1) Maximum Hanger Spacing: 6.5 ft.

2) Hanger Rod Diameter: 3/8 inches.

b. Pipe Size: 1-1/2 inches to 2 inches:

1) Maximum Hanger Spacing: 10 ft.

2) Hanger Rod Diameter: 3/8 inch.

c. Pipe Size: 2-1/2 inches to 3 inches:

1) Maximum Hanger Spacing: 10 ft.

2) Hanger Rod Diameter: 1/2 inch.

d. Pipe Size: 4 inches to 6 inches:

1) Maximum Hanger Spacing: 10 ft.

2) Hanger Rod Diameter: 5/8 inch.

END OF SECTION

SECTION 232113
HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hydronic system requirements.

B. Heating water piping, above grade.

C. Chilled water piping, above grade.

D. Condenser water piping, above grade.

E. Pipe hangers and supports.

F. Unions, flanges, mechanical couplings, and dielectric connections.

G. Valves:

1.02 RELATED REQUIREMENTS

A. Section 232500 - HVAC Water Treatment: Pipe cleaning.

1.03 REFERENCE STANDARDS

A. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications 2019.

B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2016.

C. ASME B31.9 - Building Services Piping 2017.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2018.

E. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2019.

F. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers 1992,with Editorial Revision (2018).

G. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications 2007 (Reapproved 2013).

H. AWS D1.1/D1.1M - Structural Welding Code - Steel 2015, with Errata (2016).

I. AWWA C606 - Grooved and Shouldered Joints 2015.

J. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018.

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers and supports as required, as indicated, and as follows:

1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.

2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
3. Grooved mechanical joints may be used in accessible locations only.
   a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by Architect.
   b. Use rigid joints unless otherwise indicated.
4. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

D. Valves: Provide valves where indicated:
1. Provide drain valves where indicated, and if not indicated provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4-inch gate valves with cap; pipe to nearest floor drain.
2. On discharge of condenser water pumps, use spring loaded check valves.
3. Isolate equipment using butterfly valves with lug end flanges or grooved mechanical couplings.
4. For throttling, bypass, or manual flow control services, use globe, ball or butterfly valves.
5. For throttling and isolation service in chilled and condenser water systems, use only butterfly valves.
6. In heating water, chilled water or condenser water systems, butterfly valves may be used interchangeably with gate and globe valves.
7. For shut-off and to isolate parts of systems or vertical risers, use gate, ball or butterfly valves.
8. For throttling service, use plug cocks. Use non-lubricated plug cocks only when shut-off or isolating valves are also provided.

E. Welding Materials and Procedures: Comply with ASME BPVC-IX.

2.02 CHILLED WATER PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black; using one of the following joint types:
1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.
2. Threaded Joints: ASME B16.3, malleable iron fittings.
3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

2.03 CONDENSER WATER PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black.
1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings with finish matching piping; AWS D1.1/D1.1M welded.
2. Threaded Joints: ASME B16.3, malleable iron fittings with finish matching piping.

3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

2.04 **PIPE HANGERS AND SUPPORTS**

A. Provide hangers and supports that comply with MSS SP-58.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 Inches and Greater: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.
5. Hangers for Hot Pipe Sizes 6 Inches and Greater: 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 and Greater: Steel channels with welded spacers and hanger rods, cast iron roll.
8. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
9. Wall Support for Pipe Sizes 4 Inches and Greater: Welded steel bracket and wrought steel clamp.
10. Wall Support for Hot Pipe Sizes 6 Inches and Greater: 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: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
14. Floor Support for Hot Pipe Sizes 6 Inches and Greater: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
15. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
16. Inserts: Malleable iron case of galvanized 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.

B. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.

2.05 **UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS**

A. Unions for Pipe 2 Inches and Less:

1. Ferrous Piping: 150 psig malleable iron, threaded.

B. Flanges for Pipe 2 Inches and Greater:

1. Ferrous Piping: 150 psig forged steel, slip-on.
2. Gaskets: 1/16-inch-thick preformed neoprene.

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.

1. Dimensions and Testing: In accordance with AWWA C606.
2. Mechanical Couplings: Comply with ASTM F1476.
3. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
4. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
5. When pipe is field grooved, provide coupling manufacturer's grooving tools.

PART 3 EXECUTION

3.01 **PREPARATION**

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare piping connections to equipment using jointing system specified.

E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

F. After completion, fill, clean, and treat systems. Refer to Section 232500 for additional requirements.

3.02 **INSTALLATION**

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner, parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and to avoid interfere with use of space.

D. Group piping whenever practical at common elevations.

E. Sleeve pipe passing through partitions, walls and floors.

F. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified.

G. Slope piping and arrange to drain at low points.

H. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9, ASTM F708 or MSS SP-58.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2-inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.

7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

3.03 **SCHEDULES**

A. Hanger Spacing for Copper Tubing.

1. 1/2 inch and 3/4 inch: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. 1 inch: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. 1-1/2 inch and 2 inch: Maximum span, 8 feet; minimum rod size, 3/8 inch.
4. 2-1/2 inch: Maximum span, 9 feet; minimum rod size, 3/8 inch.
5. 3 inch: Maximum span, 10 feet; minimum rod size, 3/8 inch.
6. 4 inch: Maximum span, 12 feet; minimum rod size, 1/2 inch.

B. Hanger Spacing for Steel Piping.

1. 1/2-inch, 3/4 inch, and 1 inch: Maximum span, 7 feet; minimum rod size, 1/4 inch.
2. 1-1/4 inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
3. 1-1/2 inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. 2 inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
5. 2-1/2 inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
6. 3 inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
7. 4 inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.
8. 6 inches: Maximum span, 17 feet; minimum rod size, 1/2 inch.
9. 8 inches: Maximum span, 19 fee; minimum rod size, 5/8 inch.

END OF SECTION

SECTION 232114
HYDRONIC SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Compression tanks.

B. Expansion tanks.

C. Air vents.

D. Air separators.

E. Strainers.

F. Suction diffusers.

G. Combination pump discharge valves.

H. Pressure-temperature test plugs.

I. Balancing valves.

J. Combination flow controls.

K. Flow meters.

L. Relief valves.

M. Pressure reducing valves.

1.02 RELATED REQUIREMENTS

A. Section 221006 - Plumbing Piping Specialties: Backflow preventers.

B. Section 232113 - Hydronic Piping.

1.03 REFERENCE STANDARDS

A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels 2019.

PART 2 PRODUCTS

2.01 COMPRESSION TANKS

A. Construction: Closed, welded steel, tested, and stamped in accordance with ASME BPVC-VIII-1; cleaned, prime coated, and supplied with steel support saddles; with tappings for installation of accessories.

1. Pressure rating: 100 psi (690 kPa).

B. Gauge Glass Set: Brass compression stops, guard, and 3/4-inch red line glass, maximum 24 inches length, long enough to cover tank for 2 inches above bottom to 2 inches below top.

C. Quick Connect Air Inlet:

1. Compressed Air: 75 inches of 1/4 inch diameter braided reinforced air hose, air chuck, check valve, and shut-off valve on supply from control air compressor.

2. Expansion Tank: Inlet tire check valve, manual air vent, tank drain, and pressure relief valve.

D. Automatic Cold-Water Fill Assembly: Pressure reducing valve, reduced pressure, double check back flow preventer, test cocks, strainer, vacuum breaker, and valved by-pass. Refer to Section 221006.

E. Hot Water Heating System:

1. Select expansion tank pressure relief valve at 110% maximum system operating pressure or applicable ASME B31 Piping code.

2. Set pressure reducing valve at 5 psi.

F. Chilled Water System:

1. Select expansion tank pressure relief valve at 110% maximum system operating pressure or applicable ASME B31 Piping code.

2. Set pressure reducing valve at 5 psi.

2.02 **EXPANSION TANKS**

A. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psi, with flexible EPDM diaphragm or bladder sealed into tank, and steel support stand.

B. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 12 psi.

C. Automatic Cold-Water Fill Assembly: Pressure reducing valve, reduced pressure double check back flow preventer, test cocks, strainer, vacuum breaker, and valved by-pass.

2.03 **AIR VENTS**

A. Manufacturers:

B. Manual Type: Short vertical sections of 2-inch diameter pipe to form air chamber, with 1/8-inch brass needle valve at top of chamber.

C. Float Type:

1. 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.

2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

D. Washer Type:

1. Brass with hygroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring-loaded ball check valve.

2.04 **AIR SEPARATORS**

A. Dip Tube Fitting (Where Not Provided By Boiler Manufacturer):

1. For 125 psi operating pressure; to prevent free air collected in boiler from rising into system.

B. In-line Air Separators:

1. Cast iron for sizes 1-1/2 inch and smaller, or steel for sizes 2 inch and larger; tested and stamped in accordance with ASME BPVC-VIII-1; for 125 psi operating pressure.

2.05 **STRAINERS**

A. Size 2 inch (50 mm) and Under:

1. Screwed brass or iron body for 175 psi working pressure, Y pattern with 1/32-inch stainless steel perforated screen.

B. Size 2-1/2 inch to 4 inch:

1. Provide flanged, grooved iron body for 175 psi working pressure, Y pattern with 1/16-inch, 3/64-inch stainless steel perforated screen.

2.06 **SUCTION DIFFUSERS**

A. Fitting: Angle pattern, cast-iron body, threaded for 2 inch and smaller, flanged for 2-1/2 inch and larger, rated for 175 psi working pressure, with inlet vanes, cylinder strainer with 3/16 inch diameter openings, disposable 5/32 inch mesh strainer to fit over cylinder strainer, 20 mesh start up screen, and permanent magnet located in flow stream and removable for cleaning.

2.07 **PUMP CONNECTORS**

A. Flexible Connectors: Flanged, braided type with wetted components of stainless steel, sized to match piping.

1. Maximum Allowable Working Pressure: 150 psig at 120 degrees F
2. Accommodate the Following:
   a. Axial Deflection in Compression and Expansion
   b. Lateral Movement
   c. Angular Rotation: 15 degrees.
   d. Force developed by 1.5 times specified maximum allowable operating pressure.
3. End Connections: Same as specified for pipe jointing.
4. Provide necessary accessories including, but not limited to, swivel joints.

2.08 **COMBINATION PUMP DISCHARGE VALVES**

A. Valves: Straight or angle pattern, flanged cast-iron valve body with bolt-on bonnet for 175 psi operating pressure, non-slam check valve with spring-loaded bronze disc and seat, stainless steel stem, and calibrated adjustment permitting flow regulation.

2.09 **PRESSURE-TEMPERATURE TEST PLUGS**

A. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and Neoprene rated for minimum 200 degrees F

B. Application: Use extended length plugs to clear insulated piping.

2.10 **BALANCING VALVES**

A. Size 2 inch (50 mm) and Smaller:

1. Provide ball, globe style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and NPT threaded, soldered connections.
2. Metal construction materials consist of bronze, brass.
3. Non-metal construction materials consist of Teflon, EPDM, engineered resin

B. Size 2.5 inch and Larger:

1. Provide ball, globe, butterfly style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and flanged, grooved, weld end or connections.
2. Valve body construction materials consist of cast iron, carbon steel, ductile iron or

3. Internal components construction materials consist of brass, aluminum bronze, bronze, Teflon, EPDM, NORYL, engineered resin

2.11 COMBINATION FLOW CONTROLS

A. Construction: Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet with blowdown/backflush drain.

B. Calibration: Control flow within 10 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, minimum pressure 2 psi

C. Control Mechanism: Provide stainless steel or nickel-plated brass piston or regulator cup, operating against stainless steel helical or wave formed spring or elastomeric diaphragm and polyphenylsulfone orifice plate.

2.12 FLOW METERS

A. Orifice principle by-pass circuit with direct reading gauge, soldered or flanged piping connections for 125 psi (860 kPa) working pressure, with shut off valves, and drain and vent connections.

B. Direct reading with insert pitot tube, threaded coupling, for 150 psi working pressure, maximum 240 degrees F 5 percent accuracy.

C. Cast iron, wafer type, orifice insert flow meter for 250 psi working pressure, with read-out valves equipped with integral check valves with gasketed caps.

D. Calibrated, plug type balance valve with precision machined orifice, readout valves equipped with integral check valves and gasketed caps, calibrated nameplate and indicating pointer.

E. Portable meter consisting of case containing one, 3 percent accuracy pressure gauge with 0-60 feet pressure range for 500 psi maximum working pressure, color coded hoses for low- and high-pressure connections, and connectors suitable for connection to read-out valves.

2.13 RELIEF VALVES

A. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.14 PRESSURE REDUCING VALVES

A. Operation: Automatically feeds make-up water to the hydronic system whenever pressure in the system drops below the pressure setting of the valve. Refer to Section 232113.

B. Materials of Construction:

1. Valve Body: Constructed of bronze, cast iron, brass, iron
2. Internal Components: Construct of stainless steel, brass and engineered plastics, composition material

C. Connections:

1. NPT threaded: 0.50-inch, 0.75 inch
2. Soldered: 0.50 inch

D. Provide integral check valve and strainer.

E. Maximum Inlet Pressure: 100 psi

F. Maximum Fluid Temperature: 180 degrees F

G. Operating Pressure Range: Between 10 psi and 25 psi

PART 3 EXECUTION

3.01 **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 air separator on suction side of system circulation pump and connect to expansion tank.

F. Provide valved drain and hose connection on strainer blow down connection.

G. Provide pump suction fitting on suction side of base mounted centrifugal pumps where indicated. Remove temporary strainers after cleaning systems.

H. Provide combination pump discharge valve on discharge side of base mounted centrifugal pumps where indicated.

I. Support pump fittings with floor mounted pipe and flange supports.

J. Provide radiator valves on water inlet to terminal heating units such as radiation, unit heaters, and fan coil units.

K. Provide radiator balancing valves on water outlet from terminal heating units such as radiation, unit heaters, and fan coil units.

L. Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers, and expansion tanks.

M. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

N. Pipe relief valve outlet to nearest floor drain.

O. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

3.02 **EXPANSION TANK SCHEDULE**

A. Expansion Tanks:

1. Drawing Code:
2. Service:
3. Capacity:
4. Diameter:
5. Length:
6. Height:

END OF SECTION

SECTION 232123
HYDRONIC PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. In-line circulators.

B. Close-coupled pumps.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. UL 778 - Standard for Motor-Operated Water Pumps Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 HVAC PUMPS - GENERAL

A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

B. Products Requiring Electrical Connection: Listed and classified by UL or testing agency acceptable to Authority Having Jurisdiction as suitable for the purpose specified and indicated.

2.02 IN-LINE CIRCULATORS

A. Type: Horizontal shaft, single stage, direct connected, with resiliently mounted motor for in-line mounting, oil lubricated, for 125 psi (860 kPa) maximum working pressure.

B. Casing: Cast iron, with flanged pump connections.

C. Impeller: Non-ferrous keyed to shaft.

D. Bearings: Oil-lubricated bronze sleeve.

E. Shaft: Alloy steel with bronze sleeve, integral thrust collar.

F. Seal: Mechanical seal, 225 degrees F (107 degrees C) maximum continuous operating temperature.

G. Drive: Flexible coupling.

H. Electrical Characteristics:

1. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

2.03 CLOSE COUPLED PUMPS

A. Type: Horizontal shaft, single stage, close coupled, radially split casing, for 125 psi maximum working pressure.

B. Casing: Cast iron, with suction and discharge gauge ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.

C. Impeller: Bronze, fully enclosed, keyed to motor shaft extension.

D. Shaft: Stainless steel.

E. Seal: Mechanical seal, 225 degrees F maximum continuous operating temperature.

F. Seal: Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings, 230 degrees F maximum continuous operating temperature.

PART 3 EXECUTION

3.01 **INSTALLATION**

A. Install in accordance with manufacturer's instructions.

B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.

C. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close-coupled or base-mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4 inches (102 mm) and over.

D. Provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve and balancing valve on pump discharge.

E. Provide air cock and drain connection on horizontal pump casings.

F. Provide drains for bases and seals, piped to and discharging into floor drains.

G. Check, align, and certify alignment of base-mounted pumps prior to start-up.

H. Install close-coupled and base-mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place. Refer to Section 033000.

I. Lubricate pumps before start-up.

J. Provide side-stream filtration system for closed loop systems. Install across pump with flow from pump discharge to pump suction from pump tappings.

3.02 **SCHEDULES**

A. Pumps:

1. Drawing Code:
2. Manufacturer:
3. Model:
4. Seal Type:
5. Flow Capacity:
6. Head Pressure:
7. Efficiency:
8. Impeller Diameter:
9. Shut-off Head:
10. Motor Size:

END OF SECTION

SECTION 232300
REFRIGERANT PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Moisture and liquid indicators.

D. Valves.

E. Strainers.

F. Pressure relief valves.

G. Filter-driers.

1.02 REFERENCE STANDARDS

A. AHRI 710 - Performance Rating of Liquid-Line Driers 2009.

B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems and Designation and Classification of Refrigerants 2019.

C. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants 2019.

D. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications 2019.

E. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2018.

F. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes 2018.

G. ASME B31.5 - Refrigeration Piping and Heat Transfer Components 2016.

H. ASME B31.9 - Building Services Piping 2017.

I. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2018.

J. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2019.

K. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2016.

L. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2018.

M. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service 2019.

N. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding 2011 (Amended 2012).

O. AWS D1.1/D1.1M - Structural Welding Code - Steel 2015, with Errata (2016).

P. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018.

1.03 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, union, and couplings for servicing are consistently provided.

B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

C. Filter-Driers:

1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.

PART 2 PRODUCTS

2.01 **REGULATORY REQUIREMENTS**

A. Comply with ASME B31.9 for installation of piping system.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

C. Welders Certification: In accordance with ASME BPVC-IX.

D. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

2.02 **PIPING**

A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.

1. Fittings: ASME B16.22 wrought copper.

2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.

B. Copper Tube to 7/8-inch (22 mm) OD: ASTM B88 (ASTM B88M), Type K (A), annealed.

1. Fittings: ASME B16.26 cast copper.

2. Joints: Flared.

C. Steel Pipe: ASTM A53/A53M, Schedule 40, black.

1. Fittings: ASTM A234/A234M, wrought steel welding type.

2. Joints: Welded in accordance with AWS D1.1/D1.1M.

D. Pipe Supports and Anchors:

1. Provide hangers and supports that comply with MSS SP-58.

a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

2. Hangers for Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.

3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

4. Wall Support for Pipe Sizes to 3 Inches (75 mm): Cast iron hook.

5. Vertical Support: Steel riser clamp.

6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

7. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

8. Inserts: Malleable iron case of galvanized 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.

2.03 **REFRIGERANT**

A. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

B. Refrigerant: R-134a, tetrafluoroethane as defined in ASHRAE Std 34.

2.04 **MOISTURE AND LIQUID INDICATORS**

A. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi

2.05 **VALVES**

A. Packed Angle Valves:

1. Forged brass or nickel-plated forged steel, 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 psi and maximum temperature of 275 degrees F.

B. Ball Valves:

1. Two piece bolted 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 psi and maximum temperature of 300 degrees F.

C. Service Valves:

1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi.

2.06 **STRAINERS**

A. Straight Line or Angle Line Type:

1. 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 psi.

2.07 **PRESSURE RELIEF VALVES**

A. Straight Through or Angle Type: Brass body and disc, neoprene seat, factory sealed and stamped with ASME UV and National Board Certification NB, selected to ASHRAE Std 15, with standard setting of 235 psi

2.08 **FILTER-DRIERS**

A. Performance:

1. Flow Capacity - Liquid Line: ton, minimum, rated in accordance with AHRI 710.

2. Pressure Drop: 2 psi, maximum, when operating at full connected evaporator capacity.

3. Design Working Pressure: 350 psi, minimum.

B. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.

C. Construction: UL listed.

1. Connections: As specified for applicable pipe type.

PART 3 EXECUTION

3.01 **INSTALLATION**

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

E. Inserts:

1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

F. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.5.
2. Support horizontal piping as indicated.
3. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.

3.02 **FIELD QUALITY CONTROL**

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Test refrigeration system in accordance with ASME B31.5.

C. Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using halide torch. Test to no leakage.

3.03 **SCHEDULES**

A. Hanger Spacing for Copper Tubing.

1. 1/2-inch, 5/8 inch, and 7/8-inch OD: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. 1-1/8-inch OD: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. 1-3/8-inch OD: Maximum span, 7 feet; minimum rod size, 3/8 inch.
4. 1-5/8-inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. 2-1/8-inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.
6. 2-5/8-inch OD: Maximum span, 9 feet; minimum rod size, 3/8 inch .

7. 3-1/8-inch OD: Maximum span, 10 feet ; minimum rod size, 3/8 inch .
8. 3-5/8-inch OD: Maximum span, 11 feet ; minimum rod size, 1/2 inch.
9. 4-1/8-inch OD: Maximum span, 12 feet; minimum rod size, 1/2 inch .

B. Hanger Spacing for Steel Piping.

1. 1/2-inch, 3/4 inch, and 1 inch: Maximum span, 7 feet; minimum rod size, 1/4 inch.
2. 1-1/4 inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
3. 1-1/2 inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. 2 inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
5. 2-1/2 inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
6. 3 inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
7. 4 inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.

END OF SECTION

SECTION 232500
HVAC WATER TREATMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Materials.

1. System cleaner.
2. Closed system treatment (water).
3. Condenser water system treatment (cooling towers).
4. Open system treatment (humidifiers, air washers, evaporative condensers, small cooling towers, liquid coolers).

B. By-pass (pot) feeder.

C. Solution tanks.

D. Agitator.

E. Conductivity controller.

F. Water meter.

G. Solenoid valves.

H. Timers.

I. Water softeners.

1.02 RELATED REQUIREMENTS

A. Section 016000 - Product Requirements: Owner furnished treatment equipment.

1.03 REFERENCE STANDARDS

A. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate system schematic, equipment locations, and controls schematics, electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate placement of equipment in systems, piping configuration, and connection requirements.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Comply with applicable codes for addition of non-potable chemicals to building mechanical systems and to public sewage systems.

B. Comply with UL (DIR) requirements.

C. Perform work in accordance with local health department regulations.

D. Provide certificate of compliance from Authority Having Jurisdiction indicating approval of installation.

2.02 **MATERIALS**

A. System Cleaner:

1. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodiumtripoly phosphate and sodium molybdate.
2. Biocide chlorine release agents such as sodium hypochlorite or calcium hypochlorite or microbiocides such as quarternary ammonia compounds, tributyltin oxide, methylene bis (thiocyanate).

B. Closed System Treatment (Water):

1. Sequestering agent to reduce deposits and adjust pH; polyphosphate.
2. Corrosion inhibitors; boron-nitrite, sodium nitrite and borax, sodium totyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.
3. Conductivity enhancers; phosphates or phosphonates.

C. Condenser Water System Treatment (Cooling Towers):

1. Sequestering agent to inhibit scaling; phosphonates, sodium polyphosphates, lignin derivatives, synthetic polymer polyelectrolytes, or organic phosphates.
2. Acid to reduce alkalinity and pH; sulphuric acid.
3. Corrosion inhibitor; zinc-phosphate, phosphonate-phosphate, phosphonate-molybdate and phosphonate-silicate, sodium tolyltriazole, or low molecular weight polymers.
4. Biocide chlorine release agents such as sodium hypochlorite or calcium hypochlorite.

D. Open System Treatment (Humidifiers, Air Washers, Evaporative Condensers, Small Cooling Towers, Liquid Coolers):

1. Sequestering agent to inhibit scaling and corrosion inhibitor; polyphosphate.
2. Biocide chlorine release agents such as sodium hypochlorite or calcium hypochlorite.

2.03 **BY-PASS (POT) FEEDER**

A. 2-quart quick opening cap for working pressure of 175 psi.

2.04 **SOLUTION TANKS**

A. 30-gallon capacity, polyethylene, self-supporting, 1-gallon graduated markings; molded fiberglass cover with recess for mounting pump, agitator, and liquid level switch.

2.05 **AGITATOR**

A. Totally enclosed electric motor, cast iron clamp and motor mount, 1/2-inch diameter coated Type 316 stainless steel propeller.

B. Electrical Characteristics:

1. Cord and Plug: Provide unit with 6-foot cord and plug for connection to electric wiring system including grounding connector.

2.06 **CONDUCTIVITY CONTROLLER**

A. Packaged monitor controller with solid state circuiting, five percent accuracy, linear dial adjustment, built-in calibration switch, on-off switch and light, control function light, output to control circuit and recorder.

B. Electrical Characteristics:

2.07 **WATER METER**

A. Displacement type cold water meter with sealed, tamper-proof magnetic drive, impulse contact register, single pole, double throw dry contact switch.

2.08 **SOLENOID VALVES**

A. Forged brass body globe pattern, normally open or closed as required, explosion-proof and watertight solenoid enclosure, and continuous duty coil.

2.09 **TIMERS**

A. Electronic timers, infinitely adjustable over full range, 150 second- and five-minute range, mounted together in cabinet with hands-off-automatic switches and status lights.

B. Electrical Characteristics:

2.10 **WATER SOFTENERS (CONSULT CURRENT VENDOR FOR DETAILS)**

A. Performance:

1. Softening Capacity: [_____] grains.
2. Service Flow: [_____] gpm.
3. Electrical Characteristics: [_____] volts, single phase, 60 Hz.

B. Softener Tank: Glass fiber reinforced plastic tank, [_____] by [_____] by [_____] inches ([_____] by [_____] by [_____] mm) overall size, resign capacity [____] cu ft (_____ L).

C. Brine Tank: Glass fiber reinforced plastic tank, [_____] by [_____] by [_____] inches ([_____] by [_____] by [_____] mm) overall size, salt capacity [_____] lb ([_____] kg).

D. Control: Brass control valve cycled to regenerate from one to twelve-day period.

PART 3 EXECUTION

3.01 **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.

3.02 **CLEANING SEQUENCE**

A. Concentration:

1. As recommended by manufacturer.

B. Hot Water Heating Systems:

1. Apply heat while circulating, slowly raising temperature to 160 degrees F (71 degrees C) and maintain for 12 hours minimum.

2. Remove heat and circulate to 100 degrees F or less; drain systems as quickly as possible and refill with clean water.
3. Circulate for 6 hours at design temperatures, then drain.
4. Refill with clean water and repeat until system cleaner is removed.

C. Chilled Water Systems:

1. Circulate for 48 hours, then drain systems as quickly as possible.
2. Refill with clean water, circulate for 24 hours, then drain.
3. Refill with clean water and repeat until system cleaner is removed.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.04 CLOSED SYSTEM TREATMENT

A. Provide one bypass feeder on each 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.

C. Provide 3/4-inch (19 mm) water coupon rack around circulating pumps with space for 4 test specimens.

3.05 OPEN SYSTEM TREATMENT (HUMIDIFIERS)

3.06 CONDENSER WATER SYSTEMS (COOLING TOWERS)

A. Provide solution pumps to feed sequestering agent and corrosion inhibitor from solution tank into condenser water supply to tower. Provide agitator as required.

B. Provide conductivity controller to sample condenser water and operate 1-inch solenoid bleed valve and solution pumps. Provide 1/4-inch solenoid valve and piping to blowdown controller sampler wired to open when condensing water pump is operating.

C. Provide solution pump to feed diluted acid from solution tank into condenser water supply to tower.

D. Introduce algicide to tower by intermittent slug feed.

E. Provide water meter in make-up water line to tower, to activate solution pumps for preset time when condenser water pumps are running.

F. Provide liquid level switch in each solution tank to deactivate solution pump and agitator and sound local alarm bell.

G. Provide 3/4-inch water coupon rack around circulating pumps with space for 4 test specimens.

3.07 CLOSEOUT ACTIVITIES

A. Training: Train Owner's personnel on operation and maintenance of chemical treatment system.

1. Provide minimum of two hours of instruction for two people.
2. Have operation and maintenance data prepared and available for review during training.
3. Conduct training using actual equipment after treated system has been put into full operation.

3.08 MAINTENANCE

A. Perform maintenance work using competent and qualified personnel under the supervision and in the direct employ of the equipment manufacturer or original installer.

B. Provide service and maintenance of treatment systems for one year from Date of Substantial Completion.

C. 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 two copies of field service report after each visit.

D. Provide laboratory and technical assistance services during this maintenance period.

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.

END OF SECTION

SECTION 233100
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ductwork.

PART 2 PRODUCTS

2.01 DUCT ASSEMBLIES

A. Regulatory Requirements: Construct ductwork to comply with NFPA 90A standards.

B. Ducts: Galvanized steel, unless otherwise indicated.

C. Combustion Air: 1/2-inch w.g. pressure class, galvanized steel.

2.02 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.

B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

D. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

2.03 MANUFACTURED DUCTWORK AND FITTINGS

A. Double Wall Insulated Round Ducts: Round spiral lockseam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with solid inner wall.

1. Manufacture in accordance with SMACNA (DCS).

2.04 CASINGS

A. Fabricate casings in accordance with SMACNA (DCS) and construct for operating pressures indicated.

B. Mount floor mounted casings on 4-inch-high concrete curbs. At floor, rivet panels on 8-inch centers to angles.

C. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install in accordance with manufacturer's instructions.

C. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

D. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

END OF SECTION

SECTION 235100
BREECHINGS, CHIMNEYS, AND STACKS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Field fabricated breechings.

B. Type B double wall gas vents.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 220716 - Plumbing Equipment Insulation.

C. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

D. Section 263213 - Engine Generators: Exhaust silencer.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2019a.

B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2005 (Revised 2009).

1.04 QUALITY ASSURANCE

A. Designer Qualifications: Design stacks under direct supervision of a Professional Structural Engineer experienced in design of the type of work specified and licensed in the State in which the Project is located.

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

PART 2 PRODUCTS

2.01 BREECHINGS, CHIMNEYS, AND STACKS - GENERAL REQUIREMENTS

A. Regulatory Requirements:

1. Comply with applicable codes for installation of natural gas burning appliances and equipment.

2.02 FIELD FABRICATED BREECHINGS

A. Breechings Less Than 24 inches (610 mm) in Diameter: Fabricate from hot-dipped galvanized steel sheet, ASTM A653/A653M FS, with G90/Z275 coating; make longitudinal seams using pipe lock or flat lock groove seam and make end joints beaded and crimped.

B. Minimum Metal Thicknesses based on SMACNA (DCS):

1. Sizes up to 12 inches: 18 gage, 0.0478 inch.

2. Sizes 13 to 24 inches: 16 gage, 0.0598 inch.

C. Provide adjustable self-actuating barometric draft dampers, where indicated on drawings, full size of breeching.

D. Provide cleanout doors of same gage as breeching where indicated on drawings.

E. Reinforcing: Provide angle frames for rectangular breeching and flanged girth joints or angle frames for round breeching in accordance with SMACNA (DCS), at following intervals:

PART 3 EXECUTION

3.01 **INSTALLATION**

A. Install in accordance with manufacturer's instructions.

B. Install breechings with minimum of joints. Align accurately at connections, with internal surfaces smooth.

C. Support breechings from building structure, rigidly with suitable ties, braces, hangers and anchors to hold to shape and prevent buckling. Support vertical breechings, chimneys, and stacks at 12 foot (4 m) spacing, to adjacent structural surfaces, or at floor penetrations. Refer to SMACNA (DCS) for equivalent duct support configuration and size.

D. Pitch breechings with positive slope up from fuel-fired equipment to chimney or stack.

E. Insulate breechings in accordance with Section 220716.

3.02 **SCHEDULES**

A. Breechings, Chimneys and Stacks.

1. Boiler: Steel breeching, Type B chimney.

END OF SECTION

SECTION 235216
CONDENSING BOILERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured units.

B. Boiler construction.

C. Boiler trim.

D. Fuel burning system.

E. Factory installed controls.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete.

B. Section 230913 - Instrumentation and Control Devices for HVAC.

C. Section 232114 - Hydronic Specialties.

D. Section 232123 - Hydronic Pumps.

E. Section 232500 - HVAC Water Treatment.

F. Section 235100 - Breechings, Chimneys, and Stacks.

1.03 REFERENCE STANDARDS

A. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI) current edition at www.ahrinet.org.

B. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers 2019.

D. NBBI Manufacturer and Repair Directory - The National Board of Boiler and Pressure Vessel Inspectors (NBBI) Current Edition.

E. NFPA 54 - National Fuel Gas Code 2018.

F. SCAQMD 1146.1 - Emissions of Oxides of Nitrogen from Small Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters 1990 (Amended 2018).

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittals procedures.

B. Manufacturer's Factory Inspection Report: Submit boiler inspection prior to shipment.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

A. Factory assembled, factory fire-tested, self-contained, readily transported unit ready for automatic operation except for connection of water, fuel, electrical, and vent services.

B. Unit: Metal membrane wall, water or fire tube, condensing boiler on integral structural steel frame base with integral fuel burning system, firing controls, boiler trim, insulation, and removable jacket, suitable for indoor application.

2.02 **BOILER CONSTRUCTION**

A. Comply with the minimum requirements of ASME BPVC-IV and ANSI Z21.13 for construction of boilers.

B. Assembly to bear the ASME "H" stamp and comply with the efficiency requirements of the latest edition of ASHRAE Std 90.1.

C. Required Directory Listings:

1. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI); current edition at www.ahrinet.org.

2. NBBI Manufacturer and Repair Directory - The National Board of Boiler and Pressure Vessel Inspectors (NBBI); current edition at www.nationalboard.org.

D. Heat Exchanger: Construct with materials that are impervious to corrosion where subject to contact with corrosive condensable.

E. Provide adequate tappings, observation ports, removable panels, and access doors for entry, cleaning, and inspection.

F. Insulate casing with insulation material, protected and covered by heavy-gage metal jacket.

G. Factory apply boiler base and other components, that are subject to corrosion, with durable, acrylic, powder coated, painted, weather-proofed finish.

2.03 **BOILER TRIM**

A. ASME rated pressure relief valve.

B. Flow switch.

C. Electronic Low Water Cut-off: Complete with test light and manual reset button to automatically prevent firing operation whenever boiler water falls below safe level.

D. Temperature and pressure gauge.

E. Pressure Switches:

1. High gas pressure.

2. Low gas pressure.

3. Air pressure.

F. Manual reset high limit.

G. Boiler Pump (where required by boiler design):

1. Primary pump, factory supplied and sized for field installation to ensure minimum, continuous circulation through boiler.

2. Where pump is not provided by boiler manufacturer, provide pump in accordance with boiler manufacturer's recommendations.

3. Pump time delay.

2.04 **FUEL BURNING SYSTEM**

A. Provide forced draft automatic burner, pulse combustion or integral to boiler, designed to burn natural gas, propane, No. 2 fuel oil and maintain fuel-air ratios automatically.

1. Blower Design: Statically and dynamically balanced to supply combustion air; direct connected to motor.
2. Forced Draft Design: Mixes combustion air and gas to achieve 90 percent combustion efficiency.
3. Pulse Combustion Design: Self-aspirating, not requiring blower for combustion.
4. Combustion Air Filter: Protects fuel burning system from debris.

B. Gas Train: Plug valve, safety gas valve, gas-air ratio control valve, and pressure regulator controls air and gas mixture.

C. Emission of Oxides of Nitrogen Requirements: Comply with SCAQMD 1146.1 for natural gas fired system, as applicable.

D. Intakes: Combustion air intake capable of accepting free mechanical room air or direct outside air through a sealed intake pipe.

2.05 FACTORY INSTALLED CONTROLS

A. Option for internal or external (0-10) VDC control.

B. Temperature Controls:

1. Automatic reset type to control fuel burning system on-off, firing rate to maintain system operating temperature.
2. Manual reset type to control fuel burning system to prevent boiler water temperature from exceeding safe system water temperature.
3. Low-fire start time delay relay.

C. Electronic PI setpoint/modulation control system.

D. Microprocessor-based, fuel/air mixing controls.

2.06 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Provide factory tests to check construction, controls, and operation of unit.

C. Manufacturer to conduct boiler inspection prior to shipment; submit copy of inspection report to Architect.

D. Non-Complying Work: See Section 014000.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install boiler and provide connection of natural gas service in accordance with requirements of NFPA 54 and applicable codes.

C. Install boiler on concrete housekeeping base, sized minimum of 4 inches larger than boiler base in accordance with Section 033000.

D. Coordinate factory installed controls with Section 230913.

E. Coordinate provisions for water treatment in accordance with Section 232500.

F. Pipe relief valves to nearest floor drain.

G. Pipe cooled condensate produced by the combustion process from the boiler condensate connection and/or flue stack with suitable piping material to neutralizer prior to discharging into nearest floor drain.

H. Install primary boiler pump in accordance with Section 232123.

I. Provide piping connection and accessories in accordance with Section 232114.

J. Vent combustion fumes in accordance with manufacturer's recommendations. Refer to Section 235100.

3.02 CLOSEOUT ACTIVITIES

A. Demonstrate proper operation of equipment to Owner's designated representative.

B. Demonstration: Demonstrate operation of system to Owner's personnel.

1. Use operation and maintenance data as reference during demonstration.
2. Conduct walking tour of project.
3. Briefly describe function, operation, and maintenance of each component.

C. Training: Train Owner's personnel on operation and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.
3. Instructor: Manufacturer's training personnel.
4. Location: At project site.

3.03 SCHEDULES

A. Condensing Boilers:

1. Drawing Code:
2. Location:
3. Manufacturer:
4. Model:
5. Fuel:
6. Input at Sea Level:
7. Output at Sea Level:
8. Working Pressure:
9. Blower Motor Horsepower (Where applicable):
10. Primary Boiler Pump (Where applicable):

END OF SECTION

SECTION 236100
REFRIGERANT COMPRESSORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Scroll compressors.

B. Internal piping and accessories.

C. Controls and control panel.

D. Electrical power connections.

1.02 RELATED REQUIREMENTS

A. Section 232300 - Refrigerant Piping.

B. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AHRI 520 - Performance Rating of Positive Displacement Condensing Units 2004.ASHRAE Std 23.1 - Methods for Performance Testing Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Pressures of the Refrigerant 2019.

B. ASHRAE Std 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings 2013, Including All Addenda.

C. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

A. Compressor Units: Hermetic compressor and motor, with cylinder unloaders, crankcase heater, suction and discharge service valves, vibration isolators, and control panel.

B. Construction and Ratings: In accordance with AHRI 520 and UL 207. Testing shall be in accordance with ASHRAE Std 23.1.

C. Performance Ratings: Energy Efficiency Rating (EER) and Coefficient of Performance (COP) not less than prescribed by ASHRAE Std 90.1.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide for connection to electrical service.

1. Refer to Section 260583.

C. Provide connection to refrigerant piping. Refer to Section 232300.

3.02 SYSTEM STARTUP

A. Supply service of factory trained representative for a period of up to 3 days to supervise testing, dehydration and charging of machine, and start-up.

B. Supply initial charge of refrigerant and oil.

3.03 **SCHEDULES**

A. Refrigeration Compressors:

1. Drawing Code:
2. Location:
3. Manufacturer:
4. Model Number:
5. Refrigeration Effect:
6. Refrigerant:
7. Saturated Suction Temperature:
8. Saturated Discharge Temperature:
9. Steps Unloading:
10. RPM:
11. Starter Type:
12. Motor:

END OF SECTION

SECTION 236423
SCROLL WATER CHILLERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Factory-assembled packaged chiller.

B. Charge of refrigerant and oil.

C. Controls and control connections.

D. Chilled water connections.

E. Condenser water connections.

F. Electrical power connections.

1.02 REFERENCE STANDARDS

A. AHRI 550/590 - Performance Rating of Water-Chilling and Heat Pump Water-Heating Packages Using the Vapor Compression Cycle 2011.

B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems and Designation and Classification of Refrigerants 2019.

C. ASHRAE Std 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings 2013, Including All Addenda.

D. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels 2019.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2018.

F. UL 1995 - Heating and Cooling Equipment Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

PART 2 PRODUCTS

2.01 CHILLER APPLICATIONS

A. Chiller: Water-Cooled.

1. Evaporator:

a. Water Based Fouling Factor: 0.00010 sq ft hr degrees F per Btu.

2. Packaged Water-Cooled Condenser:

a. Water Based Fouling Factor: 0.00025 sq ft hr degrees F per.

2.02 CHILLERS

A. Chillers: Factory assemble and test chiller consisting of compressor(s), compressor motor(s), evaporator, condenser, enclosure, refrigeration circuits(s) and specialties, interconnecting piping, starters, and microprocessor-based controls.

1. Rating: AHRI 550/590.

2. Safety: UL 1995 and ASHRAE Std 15.
3. Construction & Testing: ASME BPVC-VIII-1 as applicable for construction type.
4. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., testing firm acceptable to the Authority Having Jurisdiction or manufacturers specifications.
5. Energy Efficiency: ASHRAE Std 90.1.
6. Enclosures:
   a. Frame:
      1) Heavy-gage steel.
      2) Factory apply hot-dipped galvanized or air-dried paint finish.
   b. Steel Chiller Cabinets:
      1) Factory apply baked on enamel, baked on powder paint or [_____] finish.
   c. Electrical Equipment: NEMA 250 or UL 1995 as applicable.

2.03 COMPRESSORS AND EVAPORATOR

A. Compressors: Hermetic scroll type.
   1. Unit: Fully hermetic type with multiple, direct drive compressors with discharge, suction and service valves.
   2. Vibration Control: Factory installed internal isolators or field installed external isolators.
   3. Oil Lubrication System: Initial oil charge, oil sump, heater, oil level, and sight glass.
   4. Capacity Reduction System: Compressor staging with control down to 12 percent of full load without the activation of hot gas by-bass.

B. Evaporator: Provide shell and tube, brazed plate or type.
   1. Shell and tube type.
      a. Shell, removable heads and tube support sheets constructed of carbon steel or
      b. Tubes: Mechanically expand and fasten, seamless, externally or internally enhanced, copper tubes into intermediate tube support sheets along the length of shell to avoid contact and relative motion between tubes.
      c. Refrigerant Working-Side Pressure Rating: 400 psig minimum.
      d. Water Working-Side Pressure Rating: 150 psig minimum.
      e. Provide with flanged, grooved connections.
      f. Insulation for all cold surfaces.
         1) Insulation is factory, field or installed on shell, connections, suction.
         2) 0.75 inches (20 mm) minimum thick, closed cell, expanded polyvinyl chloride, polyurethane, vinyl nitrate polymer insulation with a maximum k value of 0.28.
      g. Provide factory, field installed vents and water drain connections on evaporator, piping.

h. Provide factory, field installed fittings for temperature control sensors on evaporator, piping.

i. Freeze Protection for Outdoor Locations: Provide thermostatically controlled electric heater to protect from freezing at ambient temperatures down to minus 20 degrees F

2. Brazed plate type.

a. Plate Material: 316 stainless steel

b. Refrigerant Working-Side Pressure Rating: 430 psig minimum.

c. Water Working-Side Pressure Rating: 150 psig minimum.

d. Provide with flanged, grooved connections.

e. Insulation for all cold surfaces.

1) Insulation is factory, field installed on evaporator, connections, suction piping and

2) 0.75 inches minimum thick, closed cell expanded polyvinyl chloride, polyurethane, Armaflex II insulation with a maximum k value of 0.28.

f. Provide factory, field installed vents and water drain connections on evaporator, piping or

g. Provide factory, field installed fittings for temperature control sensors on evaporator, piping

h. Freeze Protection for Outdoor Locations: Provide thermostatically controlled electric heater to protect from freezing at ambient temperatures down to minus 20 degrees F.

2.04 WATER-COOLED CONDENSER

A. Provide shell and tube, brazed plate type.

1. Shell and tube type.

a. Shell, removable heads and tube support sheets constructed of carbon steel or

b. Tubes: Mechanically expand and fasten, seamless, externally or internally enhanced, copper tubes into intermediate tube support sheets along the length of shell to avoid contact and relative motion between tubes.

c. Refrigerant Working-Side Pressure Rating: 500 psig minimum.

d. Water Working-Side Pressure Rating: 150 psig minimum.

e. Provide with flanged, grooved connections.

2. Brazed plate type.

a. Plate Material: 316 stainless steel

b. Refrigerant Working-Side Pressure Rating: 505 psig minimum.

c. Water Working-Side Pressure Rating: 300 psig minimum.

d. Provide with flanged, grooved connections.

2.05 REFRIGERATION CIRCUITS

A. Provide multiple independent refrigeration circuit(s) with multiple, one or compressor(s) per circuit.

B. Provide liquid line shut-off valve, filter-drier, expansion valve, refrigerant relief device and for each independent circuit.

2.06 **INTEGRATED MICROPROCESSOR BASED DDC CONTROLS PACKAGE**

A. Pre-wire, assemble, factory mount, and test operating and safety control system consisting of a digital display or gages, on-auto-off switch, motor starters, disconnect switches, power and control wiring. Provide controls, monitoring, programmable set-points, alarms, and BAS as defined below:

1. Automatic Adjustable Operating Controls:
   a. Temperature of chilled water leaving chiller.
   b. Chiller system capacity control based on set-points and system load.
   c. Compressor short-cycling prevention.
   d. Lead/lag for multiple compressors.
   e. Automatic reset on power source failure.
   f. Load limiting.
2. Normal Operation Monitoring and Open Cover-less Displays:
   a. Hours of operation.
   b. Suction and discharge refrigerant pressures.
   c. Automatic diagnostics.
   d. Number of starts.
   e. On/off compressor status.
   f. Entering and leaving chilled water temperatures.
   g. Status of operation.
   h. Condenser water entering and leaving temperatures.
   i. Weekly purge cycle totalization if applicable.
   j. Oil pressure.
3. Set-Points:
   a. Leaving chilled water temperature.
   b. Date/time.
   c. Leaving condenser water temperature.
4. Automatic Chiller Shut-Down Safety Controls and Alarm:
   a. Automatic Reset:
      1) Chilled water flow interlock.
      2) Voltage protection (over/under).
      3) Phase reversal protection.
   b. Manual Reset:

1) Evaporator low pressure.
2) High motor winding temperature.
3) Low chilled water temperature.
4) Low chilled water flow.
5) High condenser refrigerant discharge pressure.
6) Motor current overload and phase loss.
7) Low oil flow.

c. Remote Alarm: Activate remote, audible bell upon safety shutdown of chiller.

5. Building Automation System (BAS) Communications via Shielded Cable:

a. Minimum Data Transmission to BAS:

1) All system operating conditions.
2) Capacity control information.
3) Safety shutdown conditions.

b. Minimum Operating Commands from BAS:

1) Remote unit start/stop.
2) Remote condenser water reset.
3) Remote chilled water reset.

END OF SECTION

SECTION 250500
COMMON WORK RESULTS FOR INTEGRATED AUTOMATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Common work results applicable to Division 25 sections.

1.02 RELATED REQUIREMENTS

A. Section 230553 - Identification for HVAC Piping and Equipment.

B. Section 230593 - Testing, Adjusting, and Balancing for HVAC.

C. Section 251400 - Integrated Automation Local Control Units.

D. Section 253500 - Integrated Automation Instrumentation and Terminal Devices for HVAC.

E. Section 253516 - Integrated Automation Sensors and Transmitters.

F. Section 253519 - Integrated Automation Control Valves.

G. Section 253523 - Integrated Automation Control Dampers.

H. Section 253526 - Integrated Automation Compressed Air Supply.

I. Section 253613 - Integrated Automation Power Meters.

J. Section 260553 - Identification for Electrical Systems.

1.03 DEFINITIONS

A. This article includes typical definitions used and applied throughout Division 25.

B. Cloud: Virtual private or rented server data hosting service.

C. FDD: Fault detection and diagnostics.

D. ECM: Energy conservation measure.

E. GUI: Graphical user interface.

F. HMI: Human machine interface or operator interface.

G. I-O: Input and output objects or points or field-interfaced devices.

H. IT: Information Technology or Computer-Network Agent.

I. OEM: Original equipment manufacturer or factory-provided.

J. O&M: Operations and maintenance.

K. Peer-to-Peer: Resource linking and sharing between two or more devices.

L. Point-to-Point: Device to device or system to device interconnectivity reference.

M. RO: Read-only access to controller and system.

N. RW: Read and write access to controller and system.

O. Virtual: Software-coordinated.

P. Integrated Automation Nomenclatures:

1. ATC: Automated temperature controls.

2. BAS: Building automation system or integrated automation for buildings.
3. BMS: Building management system or integrated automation for buildings.
4. DCS: Distributed control system.
5. EIS: Energy information system or EMS with built-in data analytical tools.
6. EMS: Energy management system.
7. FMS: Facility management system or enterprise integrated automation.
8. UMS: Utility Monitoring and Control System.

Q. Operator Interface Nomenclatures:

1. AWS: Advanced workstation or administrator workstation.
2. EWS: Engineer's workstation or management workstation.
3. HMI Screen: OD or operator display or user interface (UI).
4. OD: Operator display or HMI panel screen or graphic terminal.
5. OWS: Operator's workstation or supervisory workstation.
6. SCADA: Supervisory control and data acquisition.
7. Terminal Device: Same as OD or HMI.
8. User Interface (UI): Same as OD, HMI screen or terminal device.

R. Controllers or Local Control Units (LCU's) Nomenclatures:

1. AAC: Advanced application controller or programmable controller.
2. ASC: Application specific controller or pre-programmed controller.
3. BC: Building controller or network supervisory controller.
4. DDC: Distributed digital controller or direct digital controller.
5. NC: Network supervisory controller or building controller.
6. OEM: Original equipment manufacturer controller.
7. PAC: Programmable automation controller.
8. PLC: Programmable logical controller.
9. RTU: Remote terminal unit or small DDC, ASC, SA or SS.
10. SA: Smart actuator or network-connected actuated device.
11. Smart I/O or I/O: Remote input-output device.
12. SS: Smart sensor or network-connected sensor.

S. Communication Nomenclatures:

1. BBMD: Broadcast management device.
2. GEN: General.
3. GW: Gateway.

4. Protocol: Communications language, default to BACnet MS/TP for field devices and BACnet/IP for supervisory devices unless otherwise indicated per ASHRAE Std 135
5. RTR: Router.

1.04 REFERENCE STANDARDS

A. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks 2016, with Errata (2018).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation Meeting: Field-review existing conditions when the scope includes activities such as demolition, retrofits, upgrade, additions, fit-outs, and replacements in kind.

B. Product Interconnectivity Coordination:

1. Furnish and install all control and monitoring products with appurtenances external to Divisions 23 and 25 as specified in their respective sections ensuring full Division 25 compatibility in terms of direct or integrated interconnectivity.
2. Furnish Division 23-specified equipment such as chillers, boilers, air handling units, refrigeration systems, air compressors and others with their respective controls as indicated in their respective sections ensuring full Division 25 compatibility in terms of direct or integrated interconnectivity.

C. Obtain and comply with existing Owner controls standards unless specified.

D. Obtain and comply with existing Owner Information Technology standards and procedures to install new equipment, devices and networks unless specified.

E. Resources: Provide dedicated on-site personnel that cannot be shared with other external projects or clients unless stated below or acknowledged by Owner which includes:

1. Project Manager: Can be shared.
2. Project Engineer: Can be shared.
3. Project field engineer.
4. Project technicians.
5. Project installers.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Review approved submittals of interfaced products and systems furnished under other divisions.

C. Submission Format:

D. IT Submittal: Submit detailed network riser drawings to Owner's IT division for review.

E. Early Submittal Package: Includes all furnished products installed under other Divisions.

1. Part 1 - Title Sheet:
   a. Company logo.

b. Project name, address, assigned personnel, and contact information.

c. Architect name, address, and contact information.

d. Owner name, address, and contact information.

e. Commissioning (Cx) entity name, address, and contact information.

f. Project title.

g. Listing of submitted sections.

h. Table of contents.

2. Furnished Product Data:

a. Flow Sensor Schedule: Per Section 253516 requirements.

1) Show manufacturer specified duct or pipe upstream and downstream requirements per device.

2) Consult manufacturer directly for deviations required to address existing conditions which if approved are to be included as installation notes on the final submittal.

b. Meters/Sub-meter Schedule: Per Division 21, 22, 23, and 26 requirements.

c. Smart Meters/Smart Sub-meter Schedule: Per Section 253613.

d. Control Valve Schedule: Per Section 253519 requirements.

e. Control Damper Schedule: Per Section 253523 requirements.

f. Compressed Air System Schedule: Per Section 253526 requirements.

g. Other Sensors and Appurtenances: Include products such as pressure sensors (tips), temperature sensor wells, duct-pipe-surface mounted sensors.

h. Installation Instructions: Provide red-marked manufacturer product installation data to convey specific instructions.

F. Submittal Package:

1. Title sheet.

2. Detail Drawings:

a. Proposed LCU per Section 251400 requirements.

b. Typical I-O device terminations along with wire, and cable schedules.

c. Typical panel-mounted or junction box-mounted products.

d. Typical network terminations along with wire, cable, and fiber schedules.

3. Network Riser Drawings:

a. Detailed single line diagram that shows:

1) Operator interfaces, controllers, and networking components.

2) Location Reference: List specific building room where intended device is to be physically present.

3) Address Reference: Proposed IP or subnet-instance address per device. Show common subnet mask and gateway addresses with firewall specifics on each sheet.

4) Bill of Materials: List all installed products including software pieces.

b. Graphic panel samples of HMI network riser interface if different than main diagrams.

c. HMI Navigation Scheme: Provide a sketch showing smaller graphic panel samples arranged to depict proposed system navigation specifics.

4. System or Equipment Drawings:

a. System and equipment schematic diagrams.

b. I-O Riser Schematics: Show controller connectivity diagrams as well as controller schedule references for typical work such as packaged equipment and terminal units.

c. Panel Diagrams: Include sub-panels, terminal devices per Section 253500 and complete bill of materials.

d. I-O Schedules: Include bill of materials and sequence of operations.

e. Graphic Panels: Proposed samples.

5. Integrated Device Drawings: Apply 'System or Equipment Drawings' format and include object (point) reference tables.

6. Product Data: Provide red-marked product data sheets for each furnished item with associated components and accessories.

G. Closeout or As-Build: Update all approved submittal packages to reflect specifics and include:

1. Software Schedules: List all installed software pieces including controller codes and include a soft-copy of each for Owner use.

2. References:

a. Calibration Certificates: Factory or field generated as applicable.

b. Construction Administration: Red-mark submittal drawings to show issued reference numbers for issued documents such as requests for information and field directives.

c. Electrical: Red-mark scope-related construction drawings to show installed raceway, cable, wire, and tubing.

d. LEED: Provide all necessary documents and test reports required by Section 013329.02 - Sustainable Design Reporting - LEED v4 to complete the USGBC's LEED Certification process.

3. O&M Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions.

4. Software: Provide original copy of each installed product and custom codes.

5. Warranty letter.

1.07 QUALITY ASSURANCE

A. Provide products of the latest technology available unless specified.

B. Provide products listed, classified, and labeled for intended purpose.

C. Provide any unspecified product and appurtenance required to meet the functional intent of the complete integrated automation effort.

D. Contract maintenance office located within a 25-mile radius of project site.

1.08 **DELIVERY STORAGE AND HANDLING**

A. Store products in their unopened manufacturer's packaging until ready for installation at on-site work area, project designated storage area or off-site storage.

1.09 **WARRANTY**

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Type: Provide a full warranty applicable to all Division 25 for a period of one-year after warranty letter acceptance.

1. Warranty Letter:

a. Notify: Submit draft for Owner review after substantial job completion.

b. Acceptance: Receipt of signed-off copy or completion of listed punch-list items.

2. Coordination:

a. Request: Provide feedback no later than two hours from initial request.

b. Service: Execute applicable full warranty work no later than two business days from initial request.

3. Products: Repair or replace due to defect or malfunction.

4. Interface: Repair or replace product interface such as wiring, cables, tubing, and related interconnecting media due to defect or malfunction.

5. Software:

a. Controller-end: Debug and correct defect or malfunction.

b. Computer-end or Server-end: Apply manufacturer patch, update or replacement as required to correct defect, malfunction or security flaw.

c. Add-on Products: Replace with next available version after three consecutive issues such as defect, malfunction or security flaw.

PART 3 EXECUTION

2.01 **INSTALLATION**

A. Designate flow stations flow stations, flow probes, pipe wells, pressure sensor tips, valves, dampers, meters, actuators, air compressors, and related accessories for installation by applicable installers in accordance with Division 23 requirements.

B. Designate power meters, current sensors, current switches, and related accessories for installation by applicable installers in accordance with Division 26 requirements.

C. Raceways, Cable and Wires: Install per NECA 1 following project proposed or pre-defined routes. Field verify and ensure that installed items will not inhibit access to any device or limit service clearances of nearby equipment.

D. Terminations: Leave a minimum of 4 inch of loop per cable or wire end to ease future servicing needs. Accommodate excess neatly turned into a loop inside junction box, device access box or control panel wire duct as applicable.

E. Panel-mounted Items: Install per NECA 1 and leave a minimum sub-panel blank space capacity of 20 percent. Cap any unused panel box penetrations.

F. Identification: Identify and tag installed components as follows:

1. Panels:

a. Door: Fasten a 1-1/4-inch blue nameplate tag with 1-inch white characters.

b. Sub-panel Items: Apply a 1/2-inch adhesive tag suitable for damp harsh environment with 1/4-inch black characters per item. Identify and tag remote electrical panel/breaker panel feed and remote data closet with switch port as well.

2. Raceway, Cable and Wires: Comply with Section 260553. Tag each cable or conductor with both hardware and software tags when different. Include the power supply voltage only on the conductors powering the end device. Label hardwired interlocks as "Safety Interlocks".

3. Other devices: Comply with Section 230553 requirements.

G. Passive Sensors Signal Adjustment: Measure and add sensor wiring resistance to controller input definition settings to ensure accurate temperature readings.

H. Control Schematics: Provide wall-fastened laminated copy of related drawings such as schematics, wiring diagrams, schedules, and sequences of operation per system or equipment.

2.02 FIELD QUALITY CONTROL

A. See section 014000 - Quality Requirements, for additional quality requirements.

B. Verify that products were installed per manufacturer instructions.

C. Verify that all furnished only products were installed by others per respective manufacturer instructions.

D. TAB Support: Provide a minimum of two (2) resources to assist with test requirements specified in Section 230593 for one week.

E. Field Verifications:

1. Test LCU to I-O wiring and verify field raceway and cable tags.

2. Test LCU programming and apply cable resistance differences to passive devices.

3. Test LCU controllability and tune loops until attaining specified performance.

4. Test HMI to LCU connectivity wiring links and verify raceway and cable tags.

5. Test LCU-related HMI configuration such as panels, interface navigation, and alarms.

6. Test LCU-related HMI schedules, data logging setup and report generation features.

7. Completion: Mark LCU-related submittal sheets, schedules, and graphic panels upon completion of listed field verifications and include with submittals.

2.03 CLEANING

A. See Section 017419 - Construction Waste Management and Disposal, for additional cleaning requirements.

B. Execute housekeeping measures by keeping work areas neat, clean all the time.

C. Recycle or dispose discarded packaging, materials, and pieces as per contract guidelines.

2.04 COMMISSIONING

A. See Section 019113 - General Commissioning Requirements, for commissioning requirements.

B. Commissioning (Cx) Support: Provide a single technical resource to assist Commissioning Agent (CxA) with execution of functional tests specified in Section 019114 - Commissioning Authority Responsibilities for equipment or systems interfaced under this division as follows:

1. HVAC System: Four hours.
2. HVAC Equipment: One hour.
3. HVAC Terminal Unit: 1/4 hour.
4. Integrated Equipment: 1/2 hour.

C. Commissioning (Cx): Release equipment or system to Commissioning Agent (CxA) to schedule formal functional tests.

2.05 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate operation of system to Owner's personnel.

1. Use operation and maintenance data as reference during demonstration.
2. Briefly describe function, operation, and maintenance of each component.

D. Training: Train Owner's personnel on operation and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.

2.06 MAINTENANCE

A. See Section 017000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. O&M Service: Provide a separate proposal as base bid addition to include 12 full day visits by a technician and helper to execute non-warranty work which includes:

1. Modifications: Adding, modifying or deleting points, elements, devices, and features such as trends, graphs, graphic panels, and data backups.
2. Existing Controls:
   a. Off-hours emergency call backs and support.
   b. Execute maintenance tasks listed on respective O&M Manuals or develop tasks lists to do so when manuals are unavailable.

C. Clean, adjust, lubricate, and calibrate devices, sensors, panels, and thermostats.

D. Perform random system diagnostics on items such as field controllers and front-end devices such as workstations, laptops, notebooks, tablets, servers, printers, and related intercommunication devices.

E. Execute system maintenance tasks and consumable replacements as listed on the O&M Manual.

END OF SECTION

SECTION 251400
INTEGRATED AUTOMATION LOCAL CONTROL UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Smart Devices:

1. Smart sensor (SS).
2. Smart actuator (SA).

B. Application Specific Controllers (ASC):

1. Unitary controller.
2. Air handling controller.

C. Advanced application (programmable) controllers (AAC).

D. Original equipment manufacturer (OEM) controllers.

E. Remote terminal unit (RTU).

F. Programmable logic controller (PLC).

G. Programmable automation controller (PAC).

1.02 RELATED REQUIREMENTS

A. Section 250500 - Common Work Results for Integrated Automation.

B. Section 253516 - Integrated Automation Sensors and Transmitters.

C. Section 253523 - Integrated Automation Control Dampers.

1.03 REFERENCE STANDARDS

A. ASHRAE RP-1455 - Seminar 65 - Standardized Best of Class Sequences for HVAC Systems 2016.

B. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks 2016, with Errata (2018).

D. Bluetooth CS - Bluetooth Core Specification 2016, Addendum 2017.

E. FieldComm Group (FFTS) - Foundation Fieldbus Technical Specifications 2014.

F. IEEE 802.11 - IEEE Standard for Information Technology--Telecommunications and Information Exchange Between Systems Local and Metropolitan Area Networks--Specific Requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications 2016, with Errata (2017).

G. IEEE 802.3 - IEEE Standard for Ethernet 2018.

H. IEEE 802.15.4 - IEEE Standard for Low-Rate Wireless Networks 2015.

I. LonMark Interoperability Guide - LonMark Application-Layer Interoperability Guide and LonMark Layer 1-6 Interoperability Guide; Version 3.4 2005.

J. LonMark SCPT List - LonMark SCPT Master List; Version 15 2014.

K. LonMark SNVT List - LonMark SNVT Master List; Version 15 2014.

L. Modbus (PS) - The Modbus Organization Communications Protocol. Latest Update.

M. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2018.

N. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

O. ODVA (CIP) - The Common Industrial Protocol (CIP) Standards: EtherNet/IP, DeviceNet, ControlNet, and CompoNet Current Edition.

P. ProfiBus/ProfiNet SSG - ProfiBus, ProfiNet, and IO-Link Specifications, Standards and Guidelines Current Edition.

Q. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.

R. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.

1.04 **SUBMITTALS**

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. See Section 250500 for submittal requirements. Unless otherwise indicated, submittals may be arranged according to individual sections and submitted separately or combined into comprehensive package covering work of this division.

1.05 **QUALITY ASSURANCE**

1.06 **WARRANTY**

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Warrant supplied products with appurtenances to be free from defects in material and workmanship for one year.

PART 2 PRODUCTS

2.01 **MANUFACTURERS**

A. Automated Logic, a part of UTC Climate, Controls & Security, a unit of United Technologies Corporation; www.automatedlogic.com/#sle.

B. Johnson Controls International, Plc; www.johnsoncontrols.com/#sle.

C. Honeywell International, Inc; buildingcontrols.honeywell.com/#sle.

D. KMC Controls, Inc; www.kmccontrols.com/#sle.

E. Siemens Industry, Inc; www.siemens.com/#sle.

F. Trane, a brand of Ingersoll-Rand, Plc; www.trane.com/#sle.

2.02 **SMART DEVICES**

A. Smart Sensor (SS):

1. Device Type: Space refrigerant monitor (R- 410a) sensing.

2. Device Output: 0 to 5 VDC.
3. Communications Protocol: BACnet MS/TP per ASHRAE Std 135.
4. Certification: BACnet Testing Laboratory (BTL) certified device listed under the BACnet Smart Sensor (B-SS) device profile in compliance with ASHRAE Std 135.

B. Smart Actuator (SA):

1. Actuator Type: Terminal unit damper actuator.
2. Device Output: 1-relay (SPST).
3. Device Inputs: 4-inputs, 0 to 5 VDC.
4. Communications Protocol: BACnet IP per ASHRAE Std 135.
5. Certification: BACnet Testing Laboratory (BTL) certified device listed under the BACnet Smart Actuator (B-SA) device profile in compliance with ASHRAE Std 135.

2.03 APPLICATION SPECIFIC CONTROLLERS

A. Unitary Controller:

1. Inputs: 6-binary and 4-analog.
2. Outputs: 8-binary and 2-analogs (configurable).
3. Peripheral Communications: Proprietary data bus over plug-type port.
4. Memory: 512 Kb non-volatile battery-backed with a 12-bit memory bus.
5. Accessories: Transformers, on-off switch, relays, transducers, vinyl-metallic adhesive identification tags, and programing software.
6. Mounting:
   a. Field: Provide control panel complying with NEMA 250 and UL 50 or UL 50E use in non-hazardous locations such as:
      1) Indoors and Plenums: NEMA 250, Type 1.
      2) Mechanical Rooms: NEMA 250, Type 2, using any mounting orientation.
      3) Outdoors: NEMA 250, Type 4 or Type 4X with built-in heaters for extreme ambient conditions.

B. Air Handling Controller:

1. Inputs: 8-binary (configurable) and 4-analog (configurable).
2. Outputs: 8-binary (configurable) and 4-analog (configurable).
3. Peripheral Communications: Proprietary data bus over screw terminal block.
4. Memory: 16 Mb non-volatile battery-backed with a 32-bit memory bus.
5. Accessories:
   a. Zone thermostat with built-in cool-warm adjust knob, humidity sensor, occupancy override and occupancy sensor in compliance with Section 253516.

b. Accessories: Transformers, on-off switch, relays, transducers, vinyl-metallic adhesive identification tags, and programing software.

6. Mounting:

C. Wire Connections: Device to feature removable wire terminals.

D. Control Sequences: Based on ASHRAE RP-1455 for airside applications and ASHRAE Std 90.1 I-P for waterside applications.

E. Communications Protocol: BACnet MS/TP per ASHRAE Std 135.

F. Certification: BACnet Testing Laboratory (BTL) certified device listed under the BACnet Application Specific Controller (B-ASC) device profile in compliance with ASHRAE Std 135.

2.04 ADVANCED APPLICATION (PROGRAMMABLE) CONTROLLERS

A. Inputs: 10-binary and 12-analog (configurable).

B. Outputs: 8-binary (6-configurable) and 8-analog (configurable).

C. I-O Spare Capacity: Include a 20 percent object (point) allowance for incidentals.

D. Wire Connections: Device to feature removable wire terminals.

E. Memory: 32 Mb non-volatile battery-backed with a 32-bit memory bus.

F. Communications Protocol: BACnet MS/TP per ASHRAE Std 135.

G. Certification: BACnet Testing Laboratory (BTL) certified device listed under the BACnet Advanced Application Controller (B-AAC) device profile in compliance with ASHRAE Std 135.

H. Accessories: Transformers, on-off switch, relays, transducers, vinyl-metallic adhesive identification tags, and programing software.

I. Mounting:

1. Field: Provide control panel complying with NEMA 250 and UL 50 or UL 50E use in non-hazardous locations with:

a. Enclosure: Minimum size of 24 by 36 inch) with key-lockable, lever-type door handle for use on:

1) Indoors and Plenums: NEMA 250, Type 1.

2) Mechanical Rooms: NEMA 250, Type 2, using any mounting orientation.

3) Outdoors: NEMA 250, Type 4 or Type 4X with built-in heaters for extreme ambient conditions.

b. Document Pocket: Backdoor-installed with a minimum size of 1/2 inch.

c. Wire ducts sized to cover exposed wire runs.

d. Blank Space: Include a 20 percent internal space allowance for incidentals.

e. Self-supporting Structure: Provide metal channel (strut) framing system and related hardware to mount box on the floor or wall end next to equipment.

2.05 ORIGINAL EQUIPMENT MANUFACTURER (OEM) CONTROLLERS

A. Requirement: Connect OEM (factory-installed) controllers such as variable frequency drivers (VFD's), variable speed drives (VSD's), HVAC equipment including terminal units, plumbing, and fire protection equipment.

B. Gateway: Provide external data exchange interface of the device-poll type for products with different communications protocol than BACnet IP per ASHRAE Std 135.

2.06 PROGRAMMABLE LOGIC CONTROLLER (PLC)

A. Manufacturers:

1. AutomationDirect, Inc; www.automationdirect.com/#sle.
2. General Electric Company; www.geautomation.com/#sle.
3. Honeywell International, Inc; buildingcontrols.honeywell.com/#sle.
4. Rockwell Automation, Inc; www.rockwellautomation.com/#sle.
5. Schneider Electric; www.schneider-electric.us/#sle.
6. Siemens Industry, Inc; www.siemens.com/#sle.

B. Backplane (Base): Self-contained module unit featuring power supply and CPU.

C. Terminal Blocks: Panel-mounted screw terminal block segments connected via ribbon to plug-in port on module.

D. Memory: Programming and data holding capacity of 7.5 Kb.

E. Access Ports: USB and RS-232.

F. Data Logging Storage Capacity: 8 Mb, loaded into microXD card.

G. Communications Protocol: EtherNet/IP per ODVA (CIP).

H. High Availability (Redundant) Ready: Provide two communication modules.

I. Integrated Automation Gateway: Provide a device-poll data link card or module with BACnet IP per ASHRAE Std 135 as the communications protocol.

J. Inputs: 4-discrete.

K. Outputs: 4-discrete.

L. Accessories: Transformers, on-off switch, relays, transducers, vinyl-metallic adhesive identification tags, and programing software.

M. Mounting:

PART 3 EXECUTION

3.01 INSTALLATION

A. Stand-alone: Install LCU on terminal unit, equipment or system in accordance with guidelines for low voltage cabling.

B. See Section 250500 for other related installation and execution requirements.

C. Programming: Configure, download, test, and debug software codes per LCU-type to match intended application specific, custom or project-drawing-listed sequences of operation.

END OF SECTION

SECTION 253513
INTEGRATED AUTOMATION ACTUATORS AND OPERATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manual operators.

B. Pneumatic actuators.

C. Electric actuators.

1.02 RELATED REQUIREMENTS

A. Section 250500 - Common Work Results for Integrated Automation.

B. Section 253519 - Integrated Automation Control Valves.

C. Section 253523 - Integrated Automation Control Dampers.

1.03 REFERENCE STANDARDS

A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2018.

B. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.

C. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.

D. UL 555 - Standard for Fire Dampers Current Edition, Including All Revisions.

E. UL 555S - Standard for Smoke Dampers Current Edition, Including All Revisions.

F. UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. See Section 250500 for submittal requirements.

C. Submit products of this section as integral components of control valves specified in Section 253519 and control dampers specified in Section 253523. Unless otherwise indicated, submittals may be arranged according to interrelated sections and submitted separately or combined into comprehensive package covering work of this division.

1.05 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Belimo Aircontrols (USA), Inc; www.belimo.com/#sle.

B. Bonomi North America, Inc; www.bonominorthamerica.com/#sle.

C. Honeywell International, Inc; buildingcontrols.honeywell.com/#sle.

D. Johnson Controls International, PLC; www.johnsoncontrols.com/#sle.

E. Ruskin Company; www.ruskin.com/#sle.

F. Schneider Electric; www.schneider-electric.us/#sle.

G. Siemens Industry, Inc; www.siemens.com/#sle.

2.02 ACTUATORS AND OPERATORS - GENERAL

A. Actuator Capacity: Next torque size above calculated load requirement for single units. Increase selected capacity by 25 percent when multiple units are required.

B. Assembly: Products field-installed into scheduled dampers and valves.

C. Fire Protection Systems:

1. Smoke Control: UL 2043 tested, listed, and labeled for use with UL 555S listed dampers.
2. Fire-Smoke Control: UL 2043 tested, listed, and labeled for use with dampers complying with UL 555 and UL 555S.
3. Run Time: 60 second travel with a 20 second spring return on a 250 degrees F (121 degrees C) rated damper.
4. External Reset Switch: Key-operated type interfaced with fire protection device or system installed next to damper section at 48 inches (1,220 mm) above finished floor.

D. Environmental Operating Range:

1. Temperature: From minus 22 to 122 degrees F
2. Humidity: 5 to 90 percent RH (non-condensing).

2.03 MANUAL OPERATORS

A. Provide latching operator per actuator.

B. Operator Type: Hand quadrant lever.

2.04 PNEUMATIC ACTUATORS

A. Mechanical Type: Diaphragm.

B. Air Connection: 1/8-inch barbed fittings.

C. Mounting Base Type: Rigid.

D. Position Indicator: Alternate color indicator display.

E. Provide the following features and accessories where indicated or where required to complete installation:

1. Angle-rotation limiters.
2. Anti-rotation bracket.
3. ball joints.
4. Clamps.
5. Crankarms.
6. Duplex pedestal.

7. Jackshaft.
8. Mounting brackets.
9. Mounting plates.
10. Retrofit kit.
11. Rubber boot kit.
12. Shaft extension.
13. Single pedestal.
14. Swivel mounting bracket.
15. Weather shield.

F. Spring Range:

1. On-Off (2-Position):
   a. HVAC: 20 to 30 psig via external solenoid valve.
   b. Safety: 25 psig via external pneumatic relay.
   c. General: 80 psig via external manifolded solenoid-valve array.
2. Proportional (Modulation): 0 to 3 psig via external electronic to pneumatic (E-P) transducer.
3. Position Feedback: Discrete (dry) signals via mechanical switches.

2.05 **ELECTRIC ACTUATORS**

A. Mechanical Configuration:

1. On/Off or 2-Position:
   a. Input: Line voltage from starter or VFD.
   b. Power: 24 VAC.
   c. Position Feedback: Dry contact.
   d. Stroke Duration: 60 seconds, adjustable.
   e. Fail Safe Control: Spring-return.
2. Floating or Three-Position:
   a. Input: Dual, 24 VAC.
   b. Power: 24 VAC.
   c. Position Feedback: Dry contacts, (open-closed status).
   d. Stroke Duration: 90 seconds, adjustable.
   e. Fail Safe Control: Spring-return.
3. Proportional (Modulated):
   a. Input: 0 to 10 VDC.
   b. External Power: 12 VDC.

c. Position Feedback: 0 to 10 VDC.

d. Stroke Duration: 60 seconds.

e. Type: Maintenance-free brushless DC Motor.

f. Fail Safe Control: Built-in energy storage, return under 20 seconds.

g. Adjustable Settings: Stroke direction, zero, span, and offset.

B. Angle of Rotation: 95-degree, adjustable range with mechanical end stop.

C. Motor Direction: Clockwise (CW) counter-clockwise (CCW) selectable.

D. Position Indicator: Scale indicator with tracking pointer.

E. Overload Protection Type: Electronic.

F. Electrical Protection: Double-insulated.

G. Enclosure Rating: Listed as complying with NEMA 250 and UL 50 or UL 50E use in non-hazardous locations such as:

1. Indoors and Plenums: NEMA 250, Type 1.
2. Mechanical Rooms: NEMA 250, Type 2, using any mounting orientation.
3. Outdoors: NEMA 250, Type 4 or Type 4X with built-in heaters for extreme ambient conditions.

H. Provide the following features and accessories where indicated or where required to complete installation:

1. Auxiliary switches (SPST).
2. Battery backup.
3. Conduit connector.
4. Gaskets.
5. Potentiometer interface.
6. Pulse-width modulation (PWM) interface.
7. Resistor kit.
8. Terminal strip.
9. Thermal sensors.
10. Transformer.

PART 3 EXECUTION

3.01 **INSTALLATION**

A. Designate actuators and related accessories for factory assembly on assigned device in the form of valve or damper assembly. In turn assembly is to be handled by applicable installers in accordance with Division 23 requirements.

B. Terminations: Leave a minimum of 4 inch (102 mm) of loop per cable or wire end to ease future servicing needs. Accommodate excess neatly turned into a loop inside junction or actuator access box.

C. See Section 250500 for other related installation and execution requirements.

END OF SECTION

SECTION 253516
INTEGRATED AUTOMATION SENSORS AND TRANSMITTERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sensors:

1. Temperature sensor.
2. Relative humidity and dewpoint sensors
3. CO2 (carbon dioxide) sensor.
4. VOC (volatile organic compounds) sensor.
5. Differential pressure sensor.
6. Pressure sensor.
7. Dry-flow or velocity sensor.
8. Wet-flow or velocity sensor.

B. Switches:

1. Temperature switch (thermostat).
2. Low-limit temperature cutout switch (freezestat)
3. Wet-temperature switch (aquastat).
4. Humidity switch (humidistat).
5. Pressure and differential pressure switch.
6. Flow switch.
7. Current switch.
8. Damper position switch.
9. Relays.

1.02 RELATED REQUIREMENTS

A. Section 232113 - Hydronic Piping: Installation of pipe-mounted devices.

B. Section 232213 - Steam and Condensate Heating Piping: Installation of pipe-mounted devices.

C. Section 233300 - Air Duct Accessories: Installation of duct-mounted devices.

D. Section 250500 - Common Work Results for Integrated Automation.

1.03 REFERENCE STANDARDS

A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2018.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

1.05 QUALITY ASSURANCE

A. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.06 **DELIVERY STORAGE AND HANDLING**

A. Store products in manufacturer's unopened packaging until ready for installation.

1.07 **WARRANTY**

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 **SENSORS AND SWITCHES - GENERAL REQUIREMENTS**

A. Unless otherwise indicated, each sensor provided accuracy is to be within one percent of its full-scale measuring span.

B. Select devices such that their expected measured value or setpoints are at mid-span.

C. Sensor and Switch Identification:

1. Tag: Custom metalized polyester label, printed.
2. Information: Show point (object) tag and equipment tag.
3. Size: 1/2 by 1-1/2 inches.

2.02 **SENSORS**

A. Temperature Sensor:

1. Room (Zone) Temperature (Thermostat):

a. Sensor: Platinum, 1,000 ohms at 70 degrees F thin-film RTD element inside insulated thermoplastic enclosure.

b. Monitoring Range: From 32 to 104 degrees F.

c. Transmitter: Required, 0.02 percent NIST.

d. Mounting: Wall box mounting pad or base.

e. Temperature Indicator: Thermometer, built-in.

f. Setpoint Adjust (Warmer-Cooler) Override: Knob.

g. Occupancy Override: Button.

h. Occupancy Feedback: LED, red.

i. Combined Type: RH (humidity).

1) Humidity Monitoring Range: 0 to 100 percent (non-condensing).

2) CO2 Monitoring Range: 0 to 2,000 ppm

3) VOC Monitoring Range: 0 to 100 ppm.

j. Built-in Controller: Digital.

k. Cover Logo: Contractor.

l. Power Input: 14 to 30 VDC.

m. Output: Two-wire, 0 to 10 VDC.

n. Electrical Connection: Screw terminal block.

2. Outdoor Temperature:
    a. Sensor: Platinum, 1,000 ohms at 70 degrees F thin-film RTD element inside insulated thermoplastic enclosure with sun shield.
    b. Monitoring Range: From minus 50 to 140 degrees F.
    c. Transmitter: 0.02 percent NIST.
    d. Mounting: Place on [CHOICE TEXT].
    e. Combination Type: RH (humidity), 0 to 95 percent (non-condensing) range.
    f. Power Input: 14 to 30 VDC.
    g. Output: Two-wire, 0 to 10 VDC.
    h. Electrical Connection: Built-in screw terminal block.
3. Probe:
    a. Sensor: 2,252 ohms at 77 degrees F thermistor element.
    b. Monitoring Range: From 32 to 104 degrees F
    c. Transmitter: 0.02 percent NIST.
    d. Mounting Categories:
        1) Surface:
            (a) Length: 4 inches.
            (b) Location: Indoors, fasten inside Type LB conduit body.
            (c) Accessories: Include cover, sensor holder and single gang box insulation.
        2) Ceiling:
            (a) Length: 6 inches
            (b) Accessories: Include cover, sensor holder and single gang box insulation.
        3) Duct:
            (a) Length: 8 inches.
            (b) Holding-rod: Required for lengths over 12 inches.
            (c) Location: Indoor ductwork, fasten inside Type LB conduit body.
        4) Averaging Coil-discharge:
            (a) Length: 8 feet.
            (b) Mounting: Use surface-fastened rods to hold it in place.
            (c) Parallel Elements: Per manufacturer recommendation for coil size.
        5) Pipe :
            (a) Length: 6 inches
            (b) Insertion: Fitted pipe well.
            (c) Well Material:

e. Power Input: 14 to 30 VDC.

f. Output: passive RTD.

g. Electrical Connection: Two-wire, 18 to 22 AWG leads.

B. Relative Humidity and Dewpoint Sensor:

1. Connection: Screw terminal block.
2. Mounting Style: Duct.
3. Monitoring Range: 0 to 95 percent (non-condensing).
4. Response Time: 30 to 50 milliseconds.
5. Accuracy: Two percent.
6. Power Input: None, device is loop-powered.
7. Output: Two-wire, 0 to 10 VDC.

C. CO2 (Carbon Dioxide) Sensor:

1. Connection: Screw terminal block.
2. Mounting Style: Duct.
3. Monitoring Range: 0 to 2000 ppm.
4. Response Time: 30 to 50 milliseconds.
5. Accuracy: Two percent.
6. Power Input: None, device is loop-powered.
7. Output: Two-wire, 0 to 10 VDC.

D. VOC (Volatile Organic Compounds) Sensor:

1. Connection: Screw terminal block.
2. Mounting Style: Wall box, single gang.
3. Monitoring Range: 0 to 100 ppm.
4. Response Time: 30 to 50 milliseconds.
5. Accuracy: Two percent.
6. Power Input: None, device is loop-powered.
7. Output: Two-wire, 0 to 10 VDC.

E. Differential Pressure Sensor:

1. Measured Material: For gases and fluid such as water, brine, and non-corrosive fluids.
2. Mounting Style: DIN-rail, duct, outdoor, surface or wall box, single gang.
3. Monitoring Range: 0 to 0.25, inches wc.
4. Response Time: 30 to 50 milliseconds.
5. Accuracy: Two percent.

6. Linearity: 0.1 percent of calibrated span.
7. Zero and Span: Adjustable.
8. Minimum Overpressure: 150 percent over highest range value.
9. Built-in Display: Alphanumeric display.
10. Power Input: None, device is loop-powered.
11. Output: Two-wire, 0 to 10 VDC.
12. Housing: NEMA 250 Type 1.
13. Hi/Lo Port to Tip/Sensor Tube Material: Polyvinyl, black.
14. Process Connection: 1 inch.
15. Accessories: Include barbed fittings, 3-way valve manifold assembly, 3-way valve per pressure port and pressure snubber per port.

F. Pressure Sensor:

1. Measurement: Apply for absolute pressure and static pressure.
2. Measured Material: For gases and fluids such as water, brine and non-corrosive fluids.
3. Mounting Style: DIN rail, duct, outdoor, surface or wall box, single gang.
4. Monitoring Range: 0 to 10 in wc (mm hg).
5. Response Time: 30 to 50 milliseconds.
6. Accuracy: Two percent.
7. Linearity: 0.1 percent of calibrated span.
8. Zero and Span: Adjustable.
9. Minimum Overpressure: 150 percent over highest range value.
10. Built-in Display: Numeric LED.
11. Power Input: None, device is loop-powered.
12. Output: Two-wire, 0 to 10 VDC.
13. Housing: NEMA 250 Type 1.
14. Hi/Lo Port to Tip (Sensor) Tube Material: Polyvinyl, black.
15. Process Connection: 1 inch
16. Accessories: Include barbed fittings, 3-way valve per pressure port and pressure snubber per port.

G. Dry-Flow and Velocity Sensor:

1. Sensor Type: Probe, duct inserted.
2. Transmitter Type: Built-in.
3. Monitoring Range: As indicated on drawings.
4. Turndown: 10 to 1.

5. Response Time: 30 to 50 milliseconds.
6. Accuracy: Two percent.
7. Linearity: 0.1 percent of calibrated span.
8. Zero and Span: Adjustable.
9. Minimum Overpressure: 150 percent over highest range value.
10. Display: Built-in, graphic type.
11. Power Input: None, device is loop-powered.
12. Output: Two-wire, 4 to 20 mA.
13. Housing: NEMA 250 Type 1.
14. External BTU Meter: Required, provide both temperature sensors.

H. Wet-Flow and Velocity Sensor:

1. Sensor Type: Paddlewheel (rotor).
2. Transmitter Type: Built-in.
3. Monitoring Range: As indicated on drawings.
4. Turndown: 10 to 1.
5. Response Time: 30 to 50 milliseconds.
6. Accuracy: Two percent.
7. Linearity: 0.1 percent of calibrated span.
8. Zero and Span: Adjustable.
9. Minimum Overpressure: 150 percent over highest range value.
10. Display: Built-in, alphanumeric type.
11. Power Input: None, device is loop-powered.
12. Output: Two-wire, 4 to 20 mA.
13. Housing: NEMA 250 Type 1.
14. BTU Meter: Provide external temperature sensors and wells.

2.03 SWITCHES

A. General:

1. Switch Type: Electro-mechanical type unless otherwise indicated.
2. Contact Type: SPST (single-pole single-throw) unless otherwise indicated.
3. Load Service: Select contact load rating as follows:
   a. Wet Type or AC: Line voltage.
   b. Dry Type or DC: Discreet binary (digital). Use nameplate-listed load rating.

B. Temperature Switch (thermostat):

1. Device Type: Bi-metallic sensor, electromechanic.
2. Setpoint Adjust: Slider.
3. Application: Provide for 2-speed fans
4. Sensing Range: 40 to 90 degrees F
5. Mounting: Locate on duct, equipment, pipe surface or wall surface.
6. Housing Cover: Plastic.

C. Low-Limit Temperature Cutout Switch (low-limit thermostat or freezestat):

1. Configuration: Digital module tied to sensor-assembly.
2. Sensing Length: 4 feet
3. Setpoint Adjust: Slider.
4. Switch Type: SPDT, snap-action, form C in dust-protected enclosure.
5. Sensing Range: 15 to 55 degrees F
6. Mounting: Locate on cooling coil intake side.
7. Field Interface: Connect load line-voltage to stater.
8. Electrical Rating: Pilot duty, 125 VA at 125 to 600 VAC.

D. Wet-Temperature Switch (aquastat):

1. Device Type: Bi-metallic.
2. Setpoint Adjust: Knob.
3. Application: Water cooling, dump at 140 degrees F
4. Sensing Range: 80 to 200 degrees F
5. Pipe or Equipment-mounted:
   a. Probe: Install on pipe well.
   b. Probe Length: 6 inches
   c. Material for Water or Brine Use: Brass.
   d. Material for Steam and Non-HVAC Use: 316 stainless steel.
   e. Accessories: Provide thermal conductive grease.

E. Humidity Switch (humidistat):

1. Device Type: Snap-action, form C.
2. Setpoint Adjust: Slider.
3. Application: Provide for 2-speed fan and load cutout (freezestats).
4. Sensing Range: 10 to 90 percent RH, non-condensing.
5. Mounting: Install on coil discharge, duct and equipment.
6. Cover: Plastic.

7. Accessories: Include auxiliary alarm contact, alarm LED and manual reset switch.

F. Pressure and Differential Pressure Switch:

1. Measurement: Apply for static pressure.
2. Measured Material: For gases and fluids such as water, brine and non-corrosive fluids.
3. Mounting Style: DIN-rail, duct, outdoor, surface or wall box, single gang.
4. Monitoring Range: 0 to 0.25 in wc (mm hg).
5. Accuracy: Two percent.
6. Minimum Overpressure: 150 percent over highest range value.
7. Housing: NEMA 250 Type 1.
8. Hi/Lo Port to Tip (Sensor) Tube Material: Polyvinyl, black.
9. Process Connection: 1 inch
10. Accessories: Include auxiliary alarm contact, alarm LED, barbed fittings, compression fittings, 3-way valve manifold assembly, isolating siphon for steam service, manual reset switch and pipe-mounted pressure tip-sensor.

G. Flow Switch:

1. Measured Material: For gases and fluids such as water, brine and non-corrosive fluids.
2. Device Type: Vane-operated.
3. Mounting: Install on duct or pipe.
4. Setpoint Adjust: Screw, concealed.
5. Measuring Range: As indicated on drawings.
6. Accuracy: Two percent.
7. Minimum Overpressure: 150 percent over highest range value.
8. Housing: NEMA 250 Type 1.
9. Process Connection: 1-inch threaded pipe fitting.
10. Accessories: Include auxiliary alarm contact and alarm LED.

H. Current Switch:

1. Configuration: Solid-state, electro-mechanical.
2. UL Listed Core Type: Single.
3. Device Type: Current.
4. Relay Type: Fixed trip.
5. Monitoring Range: 20 Amperes.
6. Load Rating: 25 Amperes.
7. Setpoint Adjust: Screw, concealed.
8. Accessories: Include auxiliary alarm contact and alarm LED.

I. Damper Position Switch:

1. Type: Damper-blade attached lever.

J. Relays:

1. Device Type: General purpose.
2. Rating: 10 Amperes at 120 to 277 VAC.
3. Mounting: Panel.
4. Contact Type: SPDT (single-pole double-throw).
5. Feedback: Integral LED.
6. Load Rating: 10 Amperes.

PART 3 EXECUTION

3.01 **INSTALLATION**

A. Provide and install products as indicated on project drawings or manufacturer-provided schematics.

B. Install in accordance with Sections 232113, 232213, and 233300.

C. See Section 250500 for other related installation and execution requirements.

END OF SECTION

SECTION 253519
INTEGRATED AUTOMATION CONTROL VALVES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solenoid valves.

B. Globe valves.

C. Ball valves.

D. Butterfly valves.

1.02 RELATED REQUIREMENTS

A. Section 232113 - Hydronic Piping: Control valve installation.

B. Section 250500 - Common Work Results for Integrated Automation.

C. Section 253513 - Integrated Automation Actuators and Operators.

1.03 REFERENCE STANDARDS

A. ANSI/FCI 70-2 - Control Valve Seat Leakage 2013.

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250 2015.

C. ASTM A536 - Standard Specification for Ductile Iron Castings 1984 (Reapproved 2014).

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. See Section 250500 for submittal requirements. Unless otherwise indicated, submittals may be arranged according to individual sections and submitted separately or combined into comprehensive package covering work of this division.

C. Develop a damper schedule equal or similar to featured sample:

1. Item Number: Sequential.
2. System:
   a. Location.
   b. Service: Assigned equipment (device) tag listed in alphabetical order.
   c. Line size.
3. Fluid:
   a. Upstream pressure.
   b. Design flow.
   c. Differential pressure.
   d. System closeoff pressure.
4. Body:
   a. Operation.

b. Cv (valve coefficient).

c. Size (according to selected Cv).

d. Connection.

e. Flow characteristic.

f. Type.

g. Manufacturer.

h. Part number.

5. Actuator:

a. Type.

b. Part number.

c. Accessories.

d. Signal:

1) Input.

2) Position feedback.

3) Manual operator.

6. Notes.

D. Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

1.05 **QUALITY ASSURANCE**

A. Schedule Confirmation: Review approved equipment submittals to confirm design data specifics like flow, pressure difference (coil or system), service temperature to confirm selections.

1.06 **DELIVERY STORAGE AND HANDLING**

A. Store products in manufacturer's unopened packaging until ready for installation.

1.07 **WARRANTY**

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Warrant supplied products with appurtenances to be free from defects in material and workmanship for one year.

PART 2 PRODUCTS

2.01 **VALVES - GENERAL REQUIREMENTS**

A. Valve Assembly: Provide commercial-grade valve type unless otherwise indicated.

B. Actuators: Where possible by the same valve manufacturer in compliance with Section 253513.

C. Identification Tag: Custom square type, brass, engraved.

1. Information: Show Cv with fail setting.

2. Fastened: Beaded chain, brass.

D. Valve Selection:

1. Flow Characteristic:

a. Equal Percentage: Water, brine and liquid service.

b. Linear: Steam service.

2. Sizing:

a. Pipeline Size: Use for 2-position (open/close) and solenoid types.

b. Cv (Valve Coefficient): Size using expected load flow and pressure drop across branch which includes coil, pipe, and fittings.

3. Materials:

a. Manufacturer suggested trim, seal and seat ring.

b. Stainless steel trim and replaceable seat ring for:

1) Water, brines or other liquids above 40 psig (275.8 kPa).

2.02 SOLENOID VALVES

A. Service: General service for air and most common liquids and gases.

B. Actuator: Factory-mounted assembly, solenoid at 24 VAC type.

C. Flow Characteristic: Include 2-way configured to fail normally closed (NC).

D. Pipe or Port Size: 1/4 inch (7 mm), NPTF.

E. Body Material:

1. Aluminum.

2. Brass.

3. Bronze.

4. Stainless steel.

F. Operating Pressure: Vacuum to 150 psig (1,034 kPa).

G. Operating Environment: Use on indoor spaces.

H. Accessories: Include in-line filter, isolation valves and pressure gauge.

2.03 GLOBE VALVES

A. Service: Use for brine (30 percent glycol), chilled water, hot water or steam.

B. Flow Characteristic: Include 2-way and 3-way mixing operation configured to fail normally open (NO).

C. Body Size:

1. Under 2-1/2 inches:

a. Connection: NPT.

b. Materials:

1) Body: Cast bronze.

2) Bonnet: Brass.

3) Stem: Stainless steel.

4) Plug: Brass.

5) Seat: Brass against elastomeric disk

6) Packing: Self-adjusting ethylene propylene rubber (EPR) ring pack u-cups.

c. Rangeability: Five to one.

d. Leakage: Class III per ANSI/FCI 70-2.

e. Maximum Pressure Differential: 25 psig.

f. Service Temperature:

1) Fluid Side: Standard, 32 to 200 degrees F.

2) Ambient Side: 32 to 104 degrees F

2. 2-1/2 inches (64 mm) and Above:

a. Connection: Flanged.

b. Materials:

1) Body: Cast Iron with black lacquer finish.

2) Stem: 316 or 303 stainless steel.

3) Trim: Bronze (chilled, hot water, and brines).

4) Plug: Brass packing, ethylene propylene terpolymer (EPT) ring packs.

5) Packing: EPDM o-ring (chilled, hot water, and brines).

c. Rangeability: 100 to one.

d. Maximum Pressure Differential: 25 psig.

e. Leakage: Class III per ANSI/FCI 70-2.

f. ANSI Rating: Class 125 per ASME B16.1

g. Service Temperature:

1) Fluid Side: High temp, 32 to 250 degrees F liquid or 15 psig steam.

2) Ambient Side: 32 to 104 degrees F

D. Actuator Requirements:

1. Assembly: Factory-mounted.

2. Input: 0 to 5 VDC configured for proportional control.

3. Close Off: Standard pressure.

4. Stroke: 75 seconds.

5. Accessories: Provide with valve position indicator and manual override.

2.04 BALL VALVES

A. Service: Use for brine (30 percent glycol), chilled water, hot water or steam at 15 to 25 psig

B. Flow Characteristic: Include 2-way and 3-way diverting operation configured to fail normally closed (NC).

C. Replacements in Kind: Provide pressure-independent type.

D. Rangeability: 500 to 1.

E. ANSI Rating: Class 150.

F. Leakage: Class IV (0.1 percent of rated capacity) per ANSI/FCI 70-2.

G. Body Size:

1. Under 2-1/2 inches:

a. Connection: NPT.

b. Materials:

1) Body: Brass.

2) Flanges: Ductile iron.

3) Ball: Chrome-plated brass.

4) Stem: Nickel-plated brass.

5) Seat: Graphite-reinforced PTFE with EPDM O-Ring backing.

6) Stem Seal: EPDM O-Rings.

7) Flow Control Disk: Thermoplastic synthetic-resin.

2. 2-1/2 inches (64 mm) and Above:

a. Connection Type: Flanged.

b. Materials:

1) Body: Brass.

2) Flanges: Ductile iron.

3) Ball: 300 series stainless steel.

4) Stem: 300 series stainless steel.

5) Seat: Graphite-reinforced PTFE with EPDM O-Ring backing.

6) Stem Seal: EPDM O-Rings.

7) Flow Control Disk: Thermoplastic synthetic-resin.

3. Service Temperature:

a. Fluid Side: 0 to 284 degrees F liquid or 25 psig steam.

b. Ambient Side: From minus 4 to 122 degrees F

H. Actuator Requirements:

1. Assembly: Factory-mounted.

2. Input: 0 to 5 VDC configured for proportional control.

3. Accessories: Provide with valve position indicator and manual override.

2.05 **BUTTERFLY VALVES**

A. Service: Use for brine (30 percent glycol), chilled water, condenser water or hot water.

B. Flow Characteristic: 2-way operation configured to fail normally closed (NC).

C. Connection Type: Flanged.

D. Rangeability: 10 to 1 between the 30 to 70 degrees F range.

E. Maximum Fluid Velocity: 12 feet/sec.

F. Leakage Rating: Bubble-tight at rated maximum differential pressure.

G. ANSI Rating: Class 250 per ASME B16.1

H. Size: 12 to 20 inches.

I. Materials:

1. Body: Cast iron.
2. Disc: 304 stainless steel.
3. Seat: EPDM (ethylene propylene diene monomer), peroxide-cured.
4. Stem: 416 stainless steel.
5. Tee: Ductile iron (3-way valves only).

J. Service Temperature:

1. Fluid Side: Minus 40 to 250 degrees F liquid or 15 psig steam.
2. Ambient Side: Minus 22 to 122 degrees F

K. Actuator Requirements:

1. Assembly: Factory-mounted.
2. Input: 0 to 5 VDC configured as indicated on drawings.

PART 3 EXECUTION

3.01 **INSTALLATION**

A. See Section 250500 for other related installation and execution requirements.

END OF SECTION

SECTION 253523
INTEGRATED AUTOMATION CONTROL DAMPERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Dampers.

B. Control dampers.

C. Louvers:

1. Operable (manually adjustable) louver.
2. Damper combined louver.
3. Airflow measuring station louver.

D. Smoke control dampers.

E. Fire-smoke control dampers.

F. Industrial grade, bubble-tight dampers.

G. Damper position switch.

1.02 RELATED REQUIREMENTS

A. Section 233300 - Air Duct Accessories: Control damper installation.

B. Section 250500 - Common Work Results for Integrated Automation.

C. Section 253513 - Integrated Automation Actuators and Operators.

1.03 REFERENCE STANDARDS

A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating 2018.

B. AMCA 511 - Certified Ratings Program for Air Control Devices 2010.

C. FLA (PAD) - Florida Building Code Online - Product Approval Directory Current Edition.

D. ICC (IFC) - International Fire Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. Miami (APD) - Approved Products Directory; Miami-Dade County Current Edition.

F. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2019.

G. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2018.

H. NFPA 92 - Standard for Smoke Control Systems 2018.

I. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives 2019.

K. UL 555 - Standard for Fire Dampers Current Edition, Including All Revisions.

L. UL 555S - Standard for Smoke Dampers Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. See Section 250500 for submittal requirements. Unless otherwise indicated, submittals may be arranged according to individual sections and submitted separately or combined into comprehensive package covering work of this division.

C. Develop a damper schedule equal or similar to featured sample:

1. Item Number: Sequential.
2. System:
   a. Location.
   b. Service: Assigned equipment (device) tag listed in alphabetical order.
3. Fluid:
   a. Design flow.
   b. Design air velocity.
4. Frame Assembly:
   a. Width or diameter.
   b. Height.
   c. Torque, calculated.
   d. Orientation.
   e. Application type.
   f. Operation type.
   g. Manufacturer.
   h. Part number.
5. Actuator:
   a. Type.
   b. Part number.
   c. Torque capacity.
   d. Quantity.
   e. Accessories.
   f. Signal:
      1) Input.
      2) Position feedback.
      3) Manual operator.
6. Notes.

D. Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

1.05 **QUALITY ASSURANCE**

1.06 **DELIVERY STORAGE AND HANDLING**

1.07 **WARRANTY**

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Warrant supplied products with appurtenances to be free from defects in material and workmanship for one year.

PART 2 PRODUCTS

2.01 **GENERAL**

A. Frame:

1. Orientation: As indicated on drawings.
2. Assembly: Commercial-grade sized damper to handle full closure against 100 percent of design static head and flow at design air velocity in either direction.
3. Position Indicator: Grooved line on shaft-end, jackshaft, or blade fastened switch with external visual indicator.

B. Certification Seal: Certified as tested in accordance with AMCA 500-D and AMCA 511 standards for air leakage, air performance, and energy efficiency.

C. Actuators:

1. Mounting: Factory-mounted per Section 253513 requirements unless directed otherwise.
2. Location: Outside of equipment.
3. Loading: Provide multiple units for damper torques beyond rated single actuator capacity.
4. Linkages: Factory-mounted jackshaft for arrays or custom larger sizes.

D. Identification Tag: Custom vinyl type, printed.

1. Information: Show cfm (lps) with fail setting and part number.
2. Fastened: Nylon tie.

2.02 **CONTROL DAMPERS**

A. Operation: Opposed type.

B. Frame:

1. Material: 12 gage galvanized steel.
2. Free-area: Single cross section.
3. Blanked-off: Split frame into two free-area sections to allow a smaller free-area to be used for a minimum airflow intake or exhaust application and secondary free-area fully blanked-off.

C. Blade:

1. Type: Single-blade rectangle shape.
2. Maximum Individual Blade Height: 8 inches.
3. Material: 12-gauge galvanized steel.

4. Authority: Opposed type, 5 to 50 percent (typically 10 percent).

D. Leakage (Allowance per Pressure Class):

1. Class 1A: 3 cfm/sf at 1-inch wg
2. Class 1: 4 cfm/sf at 1-inch wg
3. Class 2: 20 cfm/sf at 4-inch wg
4. Class 3: 80 cfm/sf at 4-inch wg

E. Insulation: Water-resistant sound absorbing material.

F. Temperature Service Range: Minus 25 to 185 degrees F

G. Other Requirements:

1. Paint Finish: Standard.
2. Rust Inhibitor Coating: Moisture and salt water-resistant.
3. Sleeve or Flange: Factory-mounted standard.
4. Duct Transition Fitting: Round.
5. Custom: Include bird screen and insect screen.

2.03 LOUVERS

A. Operable (Manually Adjustable), Drainable Louver:

1. Size: As indicated on the drawings.
2. Material: Extruded galvanized steel.
3. Paint Finish and Color: As indicated on the drawings.
4. Rust Inhibitor Coating: Standard.
5. Sleeve or Flange: Factory-mounted standard.
6. Duct Transition Fitting: Round.
7. Linkage: Concealed in frame.
8. Custom: Include architectural finish.
9. Insulation: Water-resistant sound absorbing material.
10. Mounting: Furnish with interior flat flange for installation.

B. Damper Combined, Drainable Louver:

1. Size: As indicated on the drawings.
2. Material: Extruded galvanized steel.
3. Paint Finish and Color: As indicated on the drawings.
4. Rust Inhibitor Coating: Standard.
5. Sleeve or Flange: Factory-mounted standard.
6. Duct Transition Fitting: Round.

7. Linkage: Concealed in frame.
8. Custom Features: Include architectural finish.
9. Insulation: Water-resistant sound absorbing material.
10. Mounting: Furnish with interior flat flange for installation.
11. Hurricane Zone Approved: FLA (PAD) and Miami (APD) listed using impact resistant aluminum material.

C. Airflow Measuring Station Louver:

1. Configuration: Single section with vertical blades.
2. Size: As indicated on the drawings.
3. Frame Thickness: 3 inch (76 mm).
4. Material: Extruded aluminum.
5. Finish: Mill.
6. Color: As recommended by manufacturer.
7. Rust Inhibitor Coating Requirement: Standard.
8. Output: Externally-piped pressure transducer, 3 percent accurate, 0 to 10 VDC or 0 to 5 VDC.

D. Temperature Service Range: Minus 25 to 185 degrees F

2.04 SMOKE CONTROL DAMPERS

A. Usage: Passive smoke-isolation on affected equipment, floors or areas.

B. Material: Galvanized steel.

C. Blade: Single-blade rectangle shape.

D. Damper and Actuator Certification: Listed, tested, and labeled in compliance with UL 555S.

1. Leakage: Class 1, 8 cfm/sf at 4-inch wg
2. Elevated Temperature: 350 degrees F
3. Velocity: 2,000 ft/sec

E. Factory Mutual (FM) Approval: Certified.

F. Code Compliance: Select to meet applications listed under NFPA 80, NFPA 90A, NFPA 92, NFPA 101, NFPA 105 and ICC (IFC).

G. Accessories: Include factory sleeves, temperature override switch at 160 degrees F , single-point wiring and momentary or toggle test switch.

2.05 FIRE-SMOKE CONTROL DAMPERS

A. Application: Passive smoke-isolation within fire-rated spaces.

B. Rating: 1-1/2 hour of resistance by using built-in fusible link to seal off damper section to contain heat and fire within specified resistance.

C. Material: Galvanized steel.

D. Blade: Multi-blade such as V or 3V for low to medium pressure.

E. Assembly Certification: Listed, tested, and labeled as complying with UL 555 and UL 555S.

1. Leakage: Class 1, 8 cfm/sf at 4-inch wg
2. Elevated Temperature: 165 degrees F
3. Velocity: 2,000 ft/sec

F. Factory Mutual (FM) Approval: Certified.

G. Code Compliance: Select to meet applications listed under NFPA 80, NFPA 90A, NFPA 92, NFPA 101, NFPA 105 and ICC (IFC).

H. Accessories: Include factory sleeves, temperature override switch at 160 degrees F , single-point wiring and momentary or toggle test switch.

2.06 **DAMPER POSITION SWITCH:**

A. Type: Damper-blade attached lever.

PART 3 EXECUTION

3.01 **INSTALLATION**

A. Review approved equipment submittals to confirm design data specifics like flow, pressure difference, and service temperature to select and expedite dampers.

B. Designate dampers and related accessories for installation to be handled by applicable installers in accordance with Section 233300 requirements.

C. See Section 250500 for other related installation and execution requirements.

END OF SECTION

SECTION 260519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 2 PRODUCTS

1.01 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductor Material:

1. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.

2. Tinned Copper Conductors: Comply with ASTM B33.

H. Conductor Color Coding:

1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.

2. Color Coding Method: Integrally colored insulation.

3. Color Code:

a. Equipment Ground, All Systems: Green.

1.02 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

END OF SECTION

SECTION 260533.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Intermediate metal conduit (IMC).

C. PVC-coated galvanized steel rigid metal conduit (RMC).

D. Electrical metallic tubing (EMT).

E. Rigid polyvinyl chloride (PVC) conduit.

F. Reinforced thermosetting resin conduit (RTRC).

G. Conduit fittings.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Metal clad cable (Type MC), armored cable (Type AC), and manufactured wiring systems, including uses permitted.

C. Section 260526 - Grounding and Bonding for Electrical Systems.

D. Section 260529 - Hangers and Supports for Electrical Systems.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC) 2015.

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S) 2015.

C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC) 2005.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT) 2013.

F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) 2003.

G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.

H. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit 2018.

I. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit 2013.

J. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing 2016.

K. NEMA TC 14 (SERIES) - Reinforced Thermosetting Resin Conduit and Fittings Series 2015.

L. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. UL 6 - Electrical Rigid Metal Conduit-Steel Current Edition, Including All Revisions.

N. UL 514B - Conduit, Tubing, and Cable Fittings Current Edition, Including All Revisions.

O. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings Current Edition, Including All Revisions.

P. UL 797 - Electrical Metallic Tubing-Steel Current Edition, Including All Revisions.

Q. UL 1242 - Electrical Intermediate Metal Conduit-Steel Current Edition, Including All Revisions.

1.04 **ADMINISTRATIVE REQUIREMENTS**

A. Coordination:

1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.05 **SUBMITTALS**

A. See Section 013000 - Administrative Requirements for submittals procedures.

B. Shop Drawings:

1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
2. Include proposed locations of roof penetrations and proposed methods for sealing.

C. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs and conduits 2-inch (53 mm) trade size and larger.

1.06 **QUALITY ASSURANCE**

A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 **CONDUIT APPLICATIONS**

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:

1. Under Slab on Grade: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit or reinforced thermosetting resin conduit (RTRC).

2. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.

3. Where rigid polyvinyl (PVC) conduit larger than 2-inch trade size is provided, use galvanized steel rigid metal conduit elbows for bends.

D. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC) or electrical metallic tubing (EMT).

E. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC) or electrical metallic tubing (EMT).

F. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC) or electrical metallic tubing (EMT).

G. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.

H. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC) or electrical metallic tubing (EMT).

I. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

2.02 CONDUIT REQUIREMENTS

A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.

B. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Minimum Conduit Size, Unless Otherwise Indicated:

1. Branch Circuits: 1/2-inch trade size.

2. Branch Circuit Homeruns: 3/4-inch trade size.

3. Control Circuits: 1/2-inch trade size.

4. Flexible Connections to Luminaires: 3/8-inch trade size.

5. Underground, Interior: 3/4-inch trade size.

6. Underground, Exterior: 1-inch trade size.

E. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

B. Fittings:

1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.
3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 INTERMEDIATE METAL CONDUIT (IMC)

A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

B. Fittings:

1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.
3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.05 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

B. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil.

C. PVC-Coated Fittings:

1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil.

D. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil.

2.06 ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

B. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.
   a. Do not use die cast zinc fittings.
3. Connectors and Couplings: Use compression (gland) or set-screw type.
   a. Do not use indenter type connectors and couplings.

2.07 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

B. Fittings:

1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.08 REINFORCED THERMOSETTING RESIN CONDUIT (RTRC)

A. Description: NFPA 70, Type RTRC reinforced thermosetting resin conduit complying with NEMA TC 14 (SERIES).

B. Supports: Per manufacturer's recommendations.

C. Fittings: Same type and manufacturer as conduit to be connected.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install intermediate metal conduit (IMC) in accordance with NECA 101.

E. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.

F. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

G. Conduit Support:

1. Secure and support conduits in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

H. Connections and Terminations:

1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.

3. Use suitable adapters where required to transition from one type of conduit to another.
4. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
5. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
6. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

I. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

J. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:

1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
3. Where calculated in accordance with NFPA 70 for reinforced thermosetting resin conduit (RTRC) conduit installed above ground to compensate for thermal expansion and contraction.
4. Where conduits are subject to earth movement by settlement or frost.

K. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:

1. Where conduits pass from outdoors into conditioned interior spaces.

2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

L. Provide grounding and bonding in accordance with Section 260526.

3.03 **FIELD QUALITY CONTROL**

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

D. Correct deficiencies and replace damaged or defective conduits.

3.04 **PROTECTION**

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 260553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Voltage markers.

D. Warning signs and labels.

1.02 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

1.03 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs 2011.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels 2011.

C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 70E - Standard for Electrical Safety in the Workplace 2018.

E. UL 969 - Marking and Labeling Systems Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.

a. Switchgear:

1) Identify power source and circuit number. Include location when not within sight of equipment.

2) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

b. Switchboards:

1) Identify power source and circuit number. Include location when not within sight of equipment.

2) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

c. Motor Control Centers:

1) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

d. Panelboards:

1) Identify power source and circuit number. Include location when not within sight of equipment.

2) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.

3) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

e. Enclosed switches, circuit breakers and motor controllers:

f. Busway:

2. Use voltage marker to identify highest voltage present for each piece of electrical equipment.

3. Use identification nameplate to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.

4. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.

a. Service equipment.

b. Industrial control panels.

c. Motor control centers.

d. Elevator control panels.

e. Industrial machinery.

5. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.

a. Minimum Size: 3.5 by 5 inches

b. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.

c. Service Equipment: Include the following information in accordance with NFPA 70.

1) Nominal system voltage.

2) Available fault current.

3) Clearing time of service overcurrent protective device(s).

4) Date label applied.

6. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.

7. Use warning signs to identify electrical hazards for entrances to all buildings, vaults, rooms, or enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

B. Identification for Conductors and Cables:

1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.
2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises have feeders or branch circuits served by more than one nominal voltage system.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:

1. Materials:
   a. Indoor Clean, Dry Locations: Use plastic nameplates.
   b. Outdoor Locations: Use plastic, stainless steel or aluminum nameplates suitable for exterior use.
2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:

1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

2.03 VOLTAGE MARKERS

A. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

B. Minimum Size:

1. Markers for Equipment: 1 1/8 by 4 1/2 inches.

C. Legend:

1. Markers for Voltage Identification: Highest voltage present.

D. Color: Black text on orange background unless otherwise indicated.

2.04 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:

1. Materials:
2. Minimum Size: 7 by 10 inches unless otherwise indicated.

C. Warning Labels:

1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 **INSTALLATION**

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:

1. Surface-Mounted Equipment: Enclosure front.
2. Flush-Mounted Equipment: Inside of equipment door.
3. Free-Standing Equipment: Enclosure front; also, enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Branch Devices: Adjacent to device.
6. Interior Components: Legible from the point of access.
7. Conductors and Cables: Legible from the point of access.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Mark all handwritten text, where permitted, to be neat and legible.

END OF SECTION

SECTION 260583
WIRING CONNECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 260533.13 - Conduit for Electrical Systems.

C. Section 262816.16 - Enclosed Switches.

D. Section 262913 - Enclosed Controllers.

1.03 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices 1999 (Reaffirmed 2015).

B. NEMA WD 6 - Wiring Devices - Dimensional Specifications 2016.

C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.

1. Colors: Comply with NEMA WD 1.
2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

B. Disconnect Switches: As specified in Section 262816.16 and in individual equipment sections.

C. Wire and Cable: As specified in Section 260519.

2.02 EQUIPMENT CONNECTIONS

PART 3 EXECUTION

3.01 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquid tight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION